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COVER PICTURE

The prototypes for two of the most recent designs in our current series of compact measuring instruments for home construction came together during some recent developmental work. The Protected Transistor Power Supply was described last month; the 1966 3-inch Oscilloscope is described in this issue, commencing on page 36. (Also in this issue is the design for a companion R-C Bridge.) The circuit responsible for that waveform?—a developmental transistorised quartz crystal oscillator.

Computers and human values

An overseas technical newspaper, recently to hand, carried an item about a firm in southern U.S.A., which appeared to be following a blatant policy of adding only whites to its staff. Discrimination seemed to be ruled out, because the listing of applicants for positions, the recording of jobs falling vacant and the engagement of new staff was handled as routine by a computer. Investigation showed, however, that the person responsible for programming the computer had conditioned it, perhaps unconsciously, with his own racial prejudice!

I couldn't help but feel that the item was a lot more significant than might have been inferred from the modest space which it occupied.

The automation of "hire and fire" is just one of many ways in which computers are becoming part of our modern way of life. The chances are that your rates and taxes, your gas and power bills and others of your accounts are already issued by a computer, as also the preliminary verdict on your latest overdraft. Pilot systems are in operation overseas, diagnosing sickness, issuing prescriptions and keeping clinical records.

What we have to remember is that computers have no wisdom of their own. They can record, retain and react to an enormous amount of data but only as they have been instructed by a human mind. The news item referred to is a perfect illustration of how a computer can multiply the colour prejudice of an individual programmer, without anybody having actually to observe the personal heartbreak which might result.

Just as easily, other computers can issue threatening letters to pensioner householders—or diagnoses and treatments reflecting the personal obsession of a medico-programmer.

Computer systems have no rival in the speed and accuracy with which they can get things done, but they are equally unrivalled in their ability to go on doing things automatically, with a maximum of isolation between those who make original decisions and those who are most affected thereby.

It seems to me that the rising generation of programmers and systems experts must be given a solid background of training in the humanities—otherwise we will find ourselves part of an electronic bureaucracy that will leave for dead the red-taped officialdom of the passing generation.

N. Williams

May, 1966

Absorption Spectroscopy 6
Simulation Saves Lives, Money 12
A Pioneer Passes 17
Review — Laser Beam TV .. 21
Review — Trans-Pacific TV .. 23
Review — Electronics in Britain 25
Scientific and Industrial News 27
The 1966 3-in Oscilloscope .. 36
Answer Man 49
All-Transistor R-C Bridge 53
Change in Symbols 63
Battery Charger for Cars 65
The Serviceman 71
Forum 77
Three-Band S/W Converter .. 82
Audio Topics 89
Classical Reviews 96
Documentary Records 101
Variety Fare 105
Trade Reviews 117
Amateur Band News 129
W.I.A. DX Awards List 136
Listening Around the World .. 141
Technical Books/Publications 145
Answers to Correspondents .. 149
Classified Advertisements 151
Index to Advertisers 152
Subscription Form 152
Classified Adverts. Form 152
Errata 69

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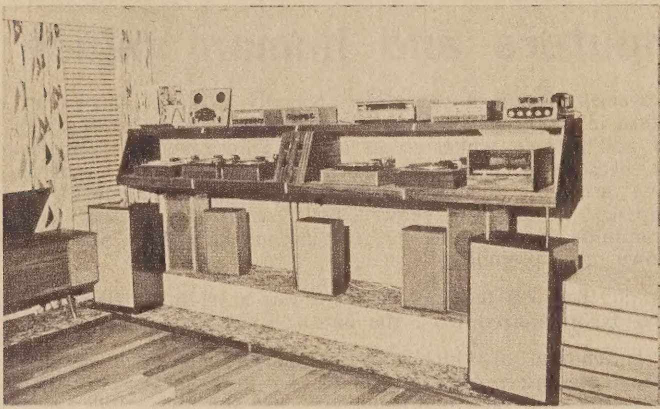

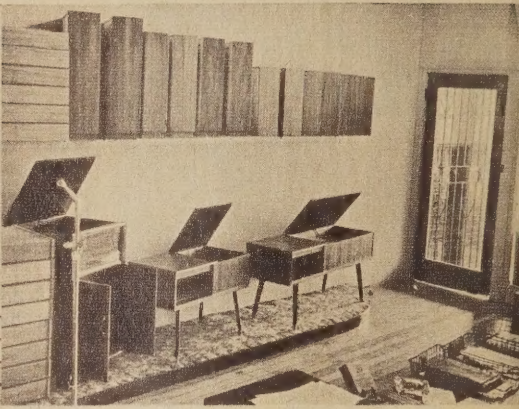

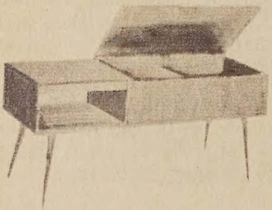

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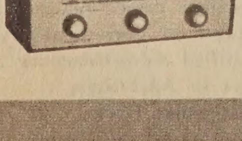

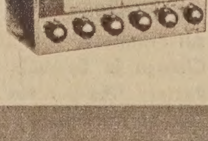

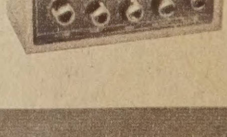

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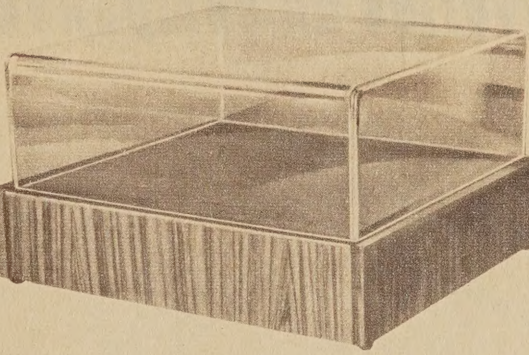

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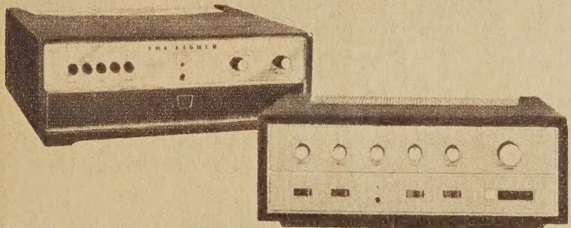

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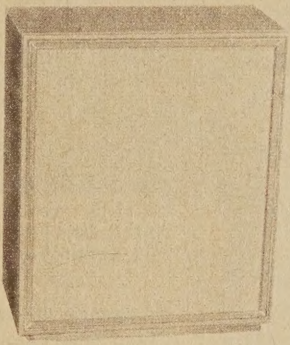

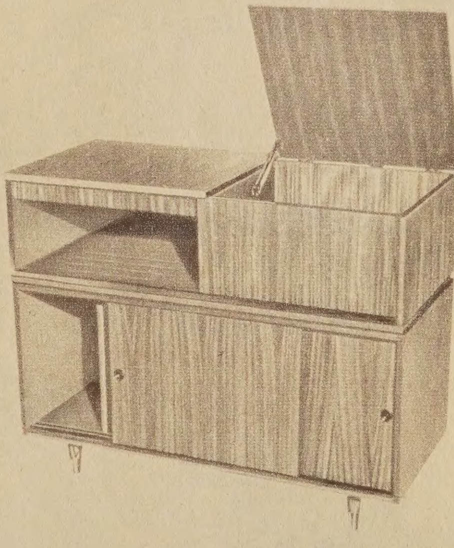

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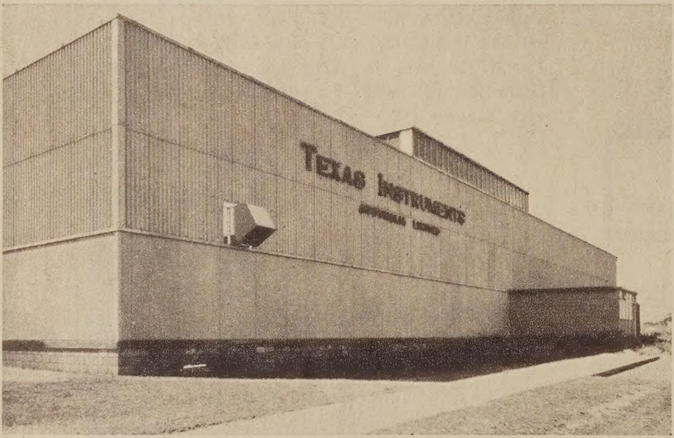

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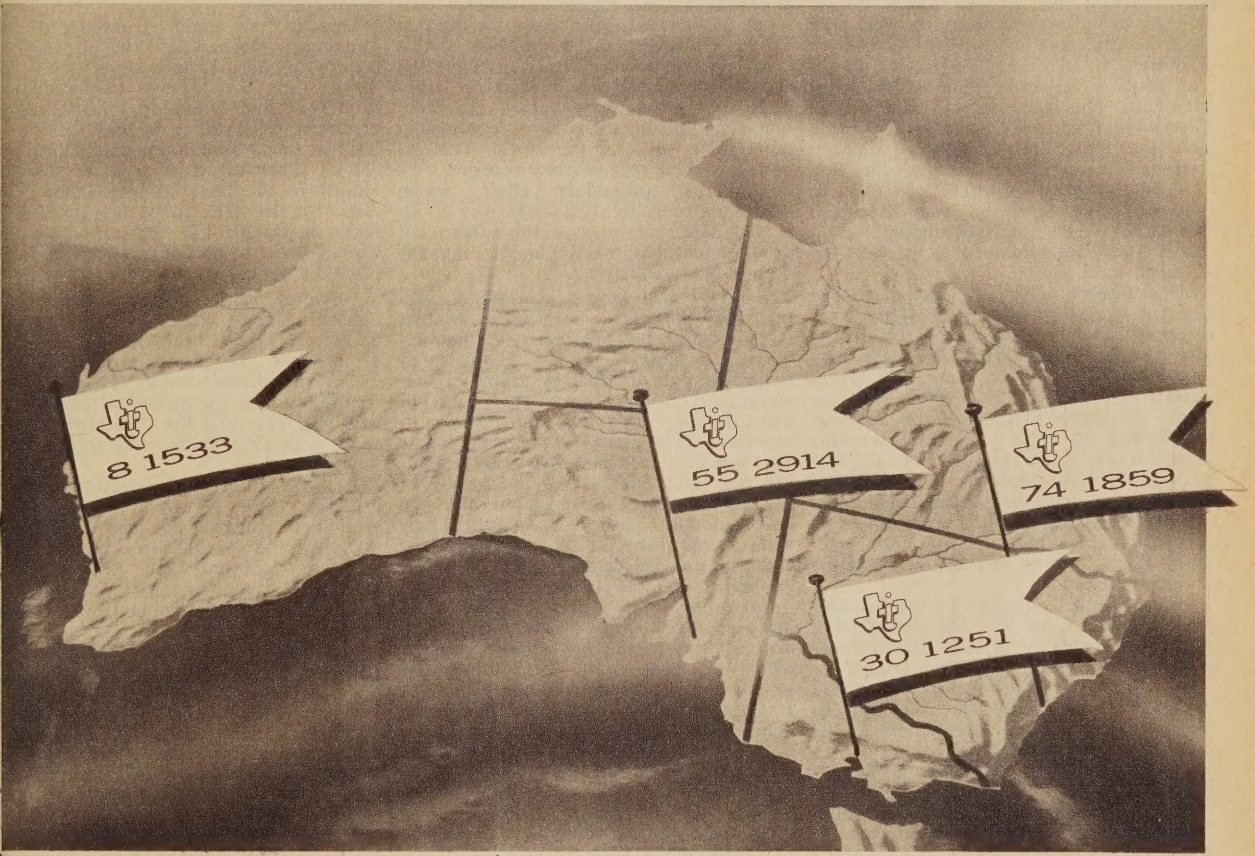

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ATOMIC ABSORPTION SPECTROSCOPY

Vital to industry, agriculture, medicine and pure research is the ability to identify and measure minute quantities of particular elements in a wide variety of liquids and solids. In this important field, scientists from Australia and New Zealand are leading the world in the discovery and application of atomic absorption spectroscopy.

On April 1, Senator J. Gorton officially opened the new C.S.I.R.O. David Rivett Laboratory in Clayton, Victoria, which is the new home of the C.S.I.R.O. Division. In so doing, he put the finishing touches on more than a decade of planning. The laboratory is named after Sir David Rivett, K.C.M.G., F.R.S., who left the Chair of Chemistry in Melbourne University to become the first Chief Executive Officer of C.S.I.R. (Council For Scientific and Industrial Research) when the Government set it up in 1926. He remained at the head of C.S.I.R. until 1949.

The Chemical Physics Section of the C.S.I.R. was formed as part of the Division of Industrial Chemistry, which was directed by Dr Ian Wark. It was largely the brain-child of Dr Wark, Sir David Rivett and Dr A. L. G. Rees, who became the leader of the Section, and was established to fulfil an urgent wartime need to set up a number of physical techniques which were just being applied to chemistry and were yielding significant results. In its twenty-first year of existence, Chemical Physics has not only been given the key to the house but the house itself!

It is situated adjacent to the Monash University campus in the belief that C.S.I.R.O. research is best located near a university, to the mutual benefit of both. In the next few years it is hoped that the 38-acre C.S.I.R.O. site will become a complex of laboratories, the Chemical Research Laboratories, all with a central interest in some aspect of chemistry.

But, in almost every developed country in the world, Australia's Division of Chemical Physics is best known to scientists as the home of Atomic Absorption: it was within the Division that Dr A. Walsh conceived the idea of this back-to-front type of spectroscopy and grappled with the many practical problems to be overcome before the technique could be used as a routine in laboratories all over the world. This inverted type of spectroscopy remains very largely an Antipodean affair, which seems appropriate! Not only was it invented here, but most of the subsequent development has taken place in Australia and New Zealand.

I have called atomic absorption spectroscopy "inverted" because it enables one to detect the presence and quantity of a particular metallic element by **absorbing** light emitted by atoms of that element. The more traditional form of spectroscopy, used for many years to measure the amount of various metallic elements in a specimen, did so by recording the light **emitted** by the atoms of the element in the specimen. To see how atomic absorption spectroscopy works, and why it is revolutionising chemical analysis in some fields, it would be better to start at the beginning.

All atoms consist of a nucleus, bearing a positive charge which is characteristic of the particular element, around which electrons orbit. The number of electrons just balances the charge on the nucleus, so that complete atoms are neutral in charge. Each electron moves in a prescribed three-dimensional orbit, but with such speed that all experiments to detect its position result in detecting a "smeared-out" picture of the electron in its orbit; thus the ubiquitous electron takes on something of the nature of a swarm of bees.

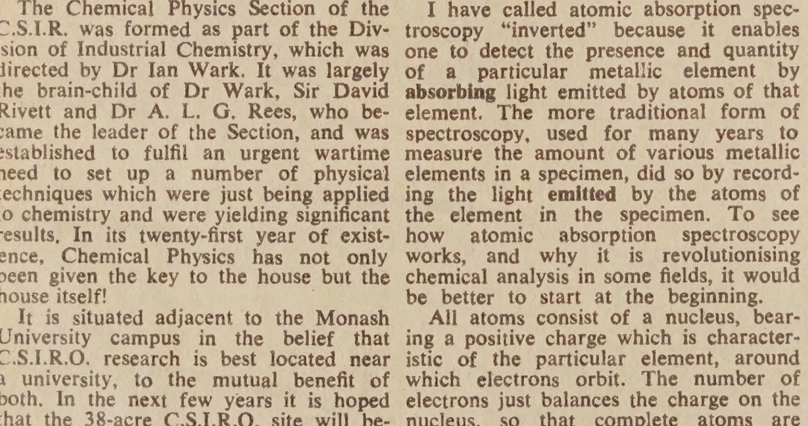


Figure 12: A prototype for a commercial version of the resonance radiation "spectrometer" produced at C.S.I.R.O. Division of Chemical Physics, Clayton, Victoria.

One of the major triumphs of the "quantum mechanics," which revolutionised modern science when it was put forward in 1926-27, was the prediction, to a very high precision, of the energy of electrons travelling in these orbits. At least in theory, quantum mechanics predicted these electron energies for all atoms; in practice the mathematics became too complex for a true prediction to be made for the heavier atoms and we still have to be content with approximate theoretical values.

However, in the case of hydrogen, the lightest element consisting of a nucleus of atomic mass 1 and bearing one unit of positive charge (a proton) around which one electron orbits (Figure 1), the solution to the mathematical problem is relatively easy and the theoretical results agree with experiment with great exactitude.

It turns out that the electron has not just one orbit in which it can move around the nucleus, but many, each having a specific energy. No orbits or energies are "allowed" the electron other than this mathematically stipulated set. Figure 2 shows diagrammatically the set of electronic energies, referred to as energy levels, for a hydrogen atom.

While the hydrogen atom is the simplest possible case, other atoms are basically similar to it in that they have sets of allowed energy levels too, but we will not complicate matters by discussing the differences and so we will assume that their energy level diagram is similar to hydrogen.

Normally the electron prefers to remain in the lowest of these energy levels, which is called the "ground state," but there are a number of ways in which it can be "raised" to a higher energy level so that the atom is said to be in an excited state. We will discuss these ways later, but let us assume for the present that an electron has found its way into a higher energy level.

Within a very short time, in general less than 10^{-8} sec., the electron will be back in the lower energy ground state. But what has happened to the extra energy E that the electron had in the excited state of the atom? Figure 3 gives the answer — it is radiated from the atom in the form of light of just the right wave-length to get rid of the excess energy E. The wavelength of the light is determined from the equation:

$$E' = h\nu = he/\lambda \quad . \; . \; . \; . \; (1$$

Where nu represents the frequency lambda is the wavelength and c the velocity of the light and h is Planck's constant.

By C. K. Coogan, M.Sc., Ph.D.

Since the exact spacing of the energy levels is characteristic of a particular atom, so the wavelengths of the light emitted are characteristic of the atom too.

It was the recognition of this experimental fact that led to the science of spectroscopy. Each atom has its own "finger print" of light emitted after it has had electrons raised into higher energy levels and these fall back to the ground state. This can be detected when the light is "dispersed" or spread out into a spectrum by a prism in the manner first discovered by Sir Isaac Newton. Alternatively the prism can be replaced by a diffraction grating.

So, in order to observe the spectrum of an element, it is necessary to raise a number of atoms of the element to excited states, and then they will return to the "ground state" automatically with the emission of spectral lines which are spread out by a prism or diffraction grating and allowed to fall on a photographic plate. Figure 4 shows diagramatically how this happens and figure 5 shows an ultra-violet emission spectrum, as photographed, of copper. As you see it is quite complex.

In order to raise electrons from the "ground state" energy level to the excited state, it is necessary to impart the requisite extra energy to the atoms. This can be done in a number of ways, the most usual of which is by heating the atoms. You can test this for yourself by dropping a pinch of salt into a flame, or by wetting a piece of paper with salt solution, drying it, and burning it. The once-seen-never-forgotten yellow of the sodium spectrum (as given out by sodium street lights) appears.

What happens is that the heat decomposes the salt, or sodium chloride (Na CL), into its constituent atoms, sodium and chlorine. Then some sodium atoms are excited by the heat into higher energy states. The number excited is given by the Boltzman equation

$$N_{ex} = N_o e^{-E_{ex}/kT} \quad . \; . \; . \; . \; (2)$$

where No is the number of atoms in the ground state, Eex is the excess energy of an excited state, T is the temperature in degrees Kelvin and k is the Boltzmann constant.

So the hotter the flame the more excited atoms and the more light given out. But even the hottest flames attainable in the laboratory, about 3,000° C say, only excite about one-thousandth of the atoms into excited states, most of them remaining in the ground state.

There are other means of exciting atoms, the most important of which depends on buffeting them with fast-moving atoms, ions, or electrons. These kind of conditions exist in the plasma of an electric discharge, and so arcs, sparks and gaseous discharges in enclosed tubes are all used to coax the atoms to give out their characteristic spectra.

All this constitutes conventional, or emission, spectroscopy. It has been built

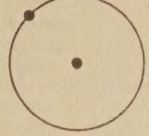


Figure 1: The hydrogen atom consisting of a proton with an electron orbiting around it.

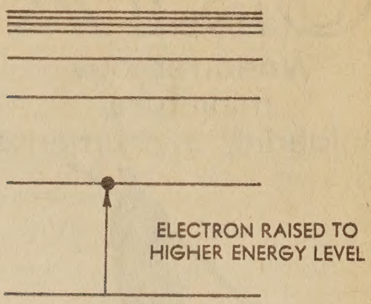


Figure 3: An electron raised by heat into the first excited state.

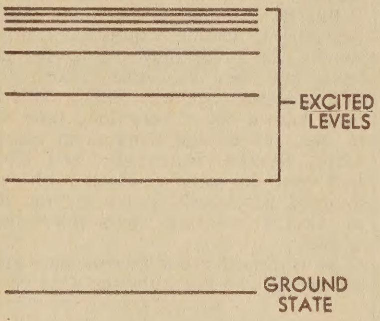


Figure 2: The allowed electron energy levels in the hydrogen atom. The electron must acquire one of these. No intermediate level is possible.

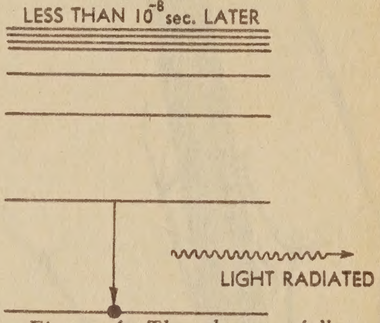


Figure 4: The electron falls back to the ground state emitting a light photon.

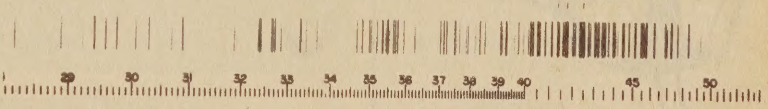
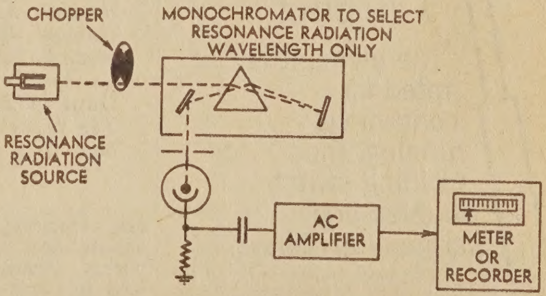


Figure 5: An ultra violet emission spectrum of copper. Unfortunately, some of the fainter lines have failed to show in this reproduction.

Figure 6: A typical atomic absorption apparatus, consisting of hollow cathode source, flame, monochromator, photocell amplifier and meter or recorder.



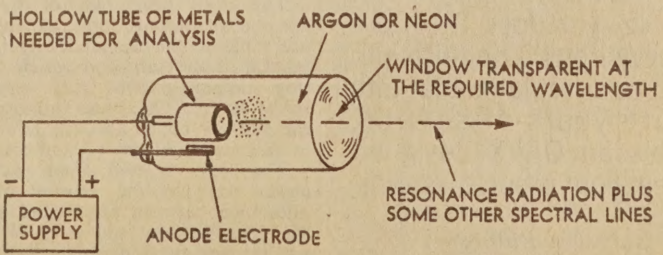


Figure 7: Schematic view of a hollow cathode lamp used as a source of atomic resonance radiation.

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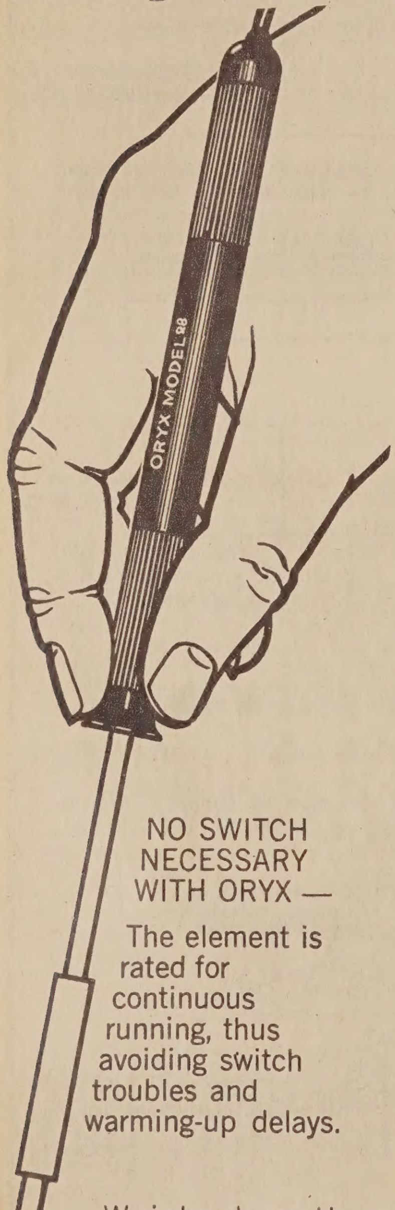

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ABSORPTION SPECTROSCOPY — continued

up to an enormously important research and routine analytical tool of very great sensitivity. Concentrations as low as one part per million (1 ppm) in a sample can be detected by these means. The manufacture of spectroscopic apparatus and supplies alone represents a multi-million dollar industry, quite apart from the enormous amount of money which the method daily saves the users, which range from police science laboratories to giant steel works. After the microscope, it probably ranks as the most widely used scientific technique.

But let us look at the other side of the coin, to use an expression common since C-day! Not only can atoms emit light, but they can also absorb light of the appropriate wavelength. This has been known for a very long time and, in fact, the earliest workers in spectroscopy, Bunsen, Fraunhofer and Kirchhoff (yes, the same gentleman who formulated Kirchhoff's Rules for the flow of electric current!) were fully aware of this.

So is almost every Intermediate grade schoolboy who does Physics! One of the first spectroscopic experiments which anyone does is to use a direct-vision pocket spectroscope at school and to look for dark lines in the spectrum of daylight (really just diffused sunlight), which are named Fraunhofer lines.

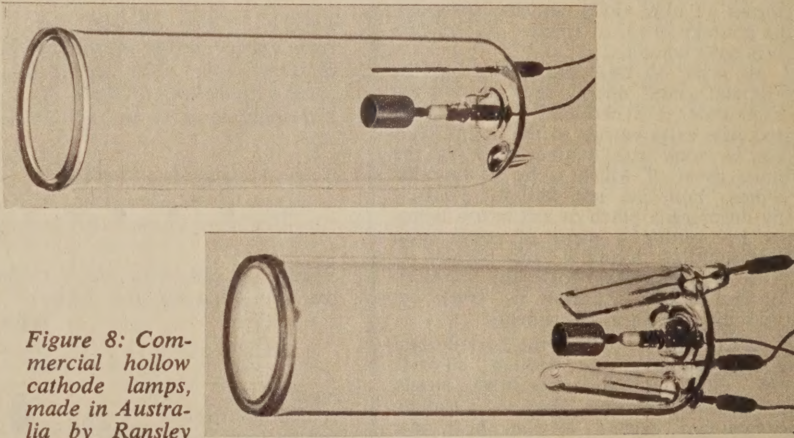


Figure 8: Commercial hollow cathode lamps, made in Australia by Ransley Glass (now Atomic Spectral Lamps Ltd.) under license to C.S.I.R.O. The bases of the lamps have been removed for clarity. The upper lamp is a low-intensity type; the lower lamp is a simplified version of the high-intensity lamp. (See figure 9.)

The most prominent of these lines are due to sodium atoms, of which there are some in the tremendously hot inner mantle of the sun, and which are emitting sodium spectral lines very powerfully. But in the outer atmosphere of the sun are cooler (a very relative term in this case!) atoms of sodium.

The light emitted from the sodium atoms has just the amount of energy difference between an excited state and the ground state, and so it is not surprising that an atom in the ground state can absorb this light and just reverse the process of emission, leaving the atom with an electron in an excited energy level. A very short time later the excited atom will have again emitted light and will have reverted to the ground state. Light of this wavelength, i.e., that appropriate to the energy difference between ground state and the first excited state, is called "resonance radiation."

All this was known in 1953 when Dr Alan Walsh, of the Division of Chemical Physics, asked himself the simple question:—"Why don't we use **absorption** rather than **emission** methods to detect the presence of an element?" The two methods appeared to be alternatives. However, the more he thought about it, the more convinced he became that atomic absorption methods were very much to be preferred. For one thing, as almost all the atoms are in the ground state at temperatures attainable in the laboratory, they could **all** absorb light and so a factor of over 1,000 in sensitivity was to be expected in favour of atomic absorption. In addition, lower temperature flames were possible as salts placed in the flame had only to be decomposed into atoms which did not need to be excited.

The only snag was that the width of spectral resonance lines in the source had to be very narrow. He had soon worked out a scheme for employing atomic absorption, which is fundamentally what has been used in practice ever since, until he and his co-workers again revolutionised the subject recently. But that story will keep till later.

The apparatus consisted of (a) a source of the resonance radiation, (b) a "chopper" or device for allowing light to pass through periodically with a fixed frequency (for example, something like a toothed wheel), (c) some means of atomising the atoms in the specimen (such as a flame), (d) a monochromator or device for selecting a given wavelength of light, which employs a prism or diffraction grating, (e) a photocell or photomultiplier, which is just a supersensitive photocell, (f) an amplifier capable of amplifying at the frequency of the "chopped" light, but ignoring any steady light signal.

For the atomiser, the type of apparatus used was originally developed almost a century before by Gouy. It is merely a Bunsen burner with a rather flat "fishtail" sort of flame into which a fine spray of liquid containing a solution of the elements to be detected is directed. Then free atoms of the elements in solution occur in the flame, more than 99.9 per cent of them being in the ground state.

Figure 6 shows how this type of apparatus works. Light from the source of "resonance" radiation of the particular element we wish to detect (say sodium) is "chopped" and then passes through the flame containing the atomised sample, which is analysed for sodium content. Then if sodium atoms are present in the flame, two things happen, (a) the sodium atoms absorb the sodium resonance radiation in proportion to their number in the flame and (b) some weak sodium resonance light is emitted by the 0.1 per cent or so sodium atoms excited by the flame.

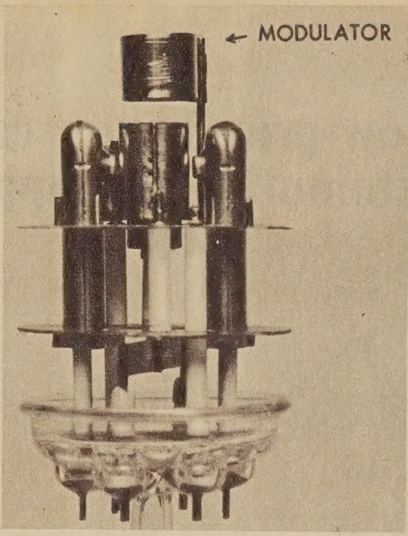
It is relatively easy to distinguish between the light from atoms excited by the flame, which is steady "DC" type, and light which we want to measure from the "chopped" source, which is "AC" type, as only the AC component is amplified in the associated AC metering amplifier and the DC component is ignored.

The gain of the amplifier can be adjusted so that 100 is read on the meter when no sodium atoms are in the flame, allowing the percentage diminution in the meter deflection to be read off when absorbing atoms are present. For each element to be detected the appropriate resonance wavelength is selected on the monochromator and the appropriate resonance radiation source used.

One of the greatest advantages of the method is that it is much freer from troublesome interferences of the kind encountered in emission spectroscopy. In emission, the presence of one element in the specimen may largely modify the amount of light emitted by another, so that it is really necessary to know what proportions of other elements are in the sample when trying to analyse for a specific element.

When the fundamentals of the method were established there were still a number of obstacles to be overcome. The first was the production of suitable sources of resonance radiation. This problem was solved by using hollow-cathode discharge lamps, similar to those in figure 7. Each lamp consists of a glass tube containing two electrodes, the cathode being a hollow cylinder made of the element whose resonance radiation is desired.

The tube is filled with a very low pressure of a non-reactive gas such as neon or argon. An electrical discharge through the gas causes gas ions to bombard the metal cathode, which "knocks out" free metal atoms to form a metallic gas in and around the cathode. These metal atoms in turn are bombarded by ions and electrons and become excited, emitting resonance radiation.



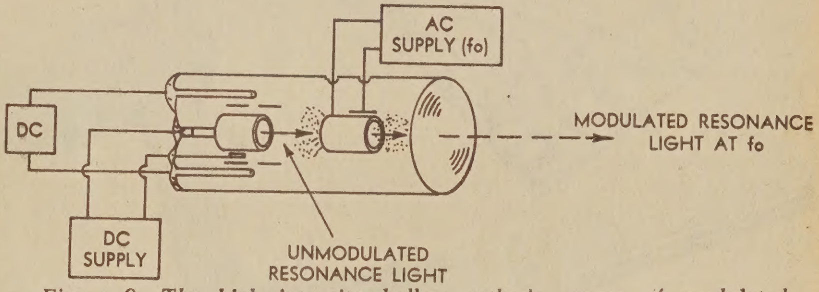
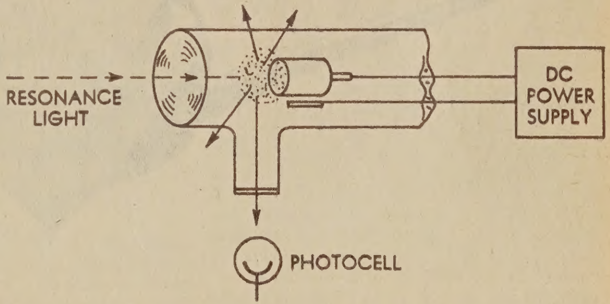


Figure 9: The high intensity hollow cathode source of modulated resonance radiation. The schematic diagram shows how the fluctuating cloud of atoms in the low intensity hollow cathode lamp modulates the resonance radiation from the high intensity lamp in the one envelope. An actual prototype lamp assembly is shown above.

Figure 10: The resonance radiation detector. The atoms produced near the low intensity hollow cathode lamp absorb incoming resonance radiation and re-emit it in all directions.



The problem was that hollow-cathode discharge lamps, which had been in spasmodic use for many years in spectroscopic work, needed to be pumped continuously and had a very short lifetime. Dr Walsh and his co-workers evolved sealed-off hollow-cathode lamps for a wide range of elements which had lifetimes at least as great as the guaranteed 1000 hours of a radio valve!

Figure 8 shows some commercial lamps made in Australia, to the C.S.I.R.O. design. Don't be fooled by their deceptive simplicity!

Another requirement was an audio-amplifier for amplifying only at the frequency of the chopped light, and a suitable circuit was connected within the main requirements of low cost and dependability. This was originally and facetiously dubbed the "Working Man's Amplifier," and the initials "WMA" can now be found on many glossy boxes of more advanced electronics all over the world; the owners seldom know what the initials stand for!

But still a lot of people had to be convinced that the laboratory pipe-dream could be useful in day-to-day applications. It is largely to the credit of Dr John Willis of the Division of Chemical Physics, Mr John David, of the C.S.I.R.O. Division of Plant Industry, in Canberra, and Mr Eric Allan, of the New Zealand Department of Agriculture, that they were!

Mr David quickly recognised the worth of atomic absorption in the difficult determination of trace elements in soils and plants. Independently, in New Zealand, Mr Allan had come to the same conclusions regarding similar work, and they both began publishing papers which made a great impact among agricultural scientists.

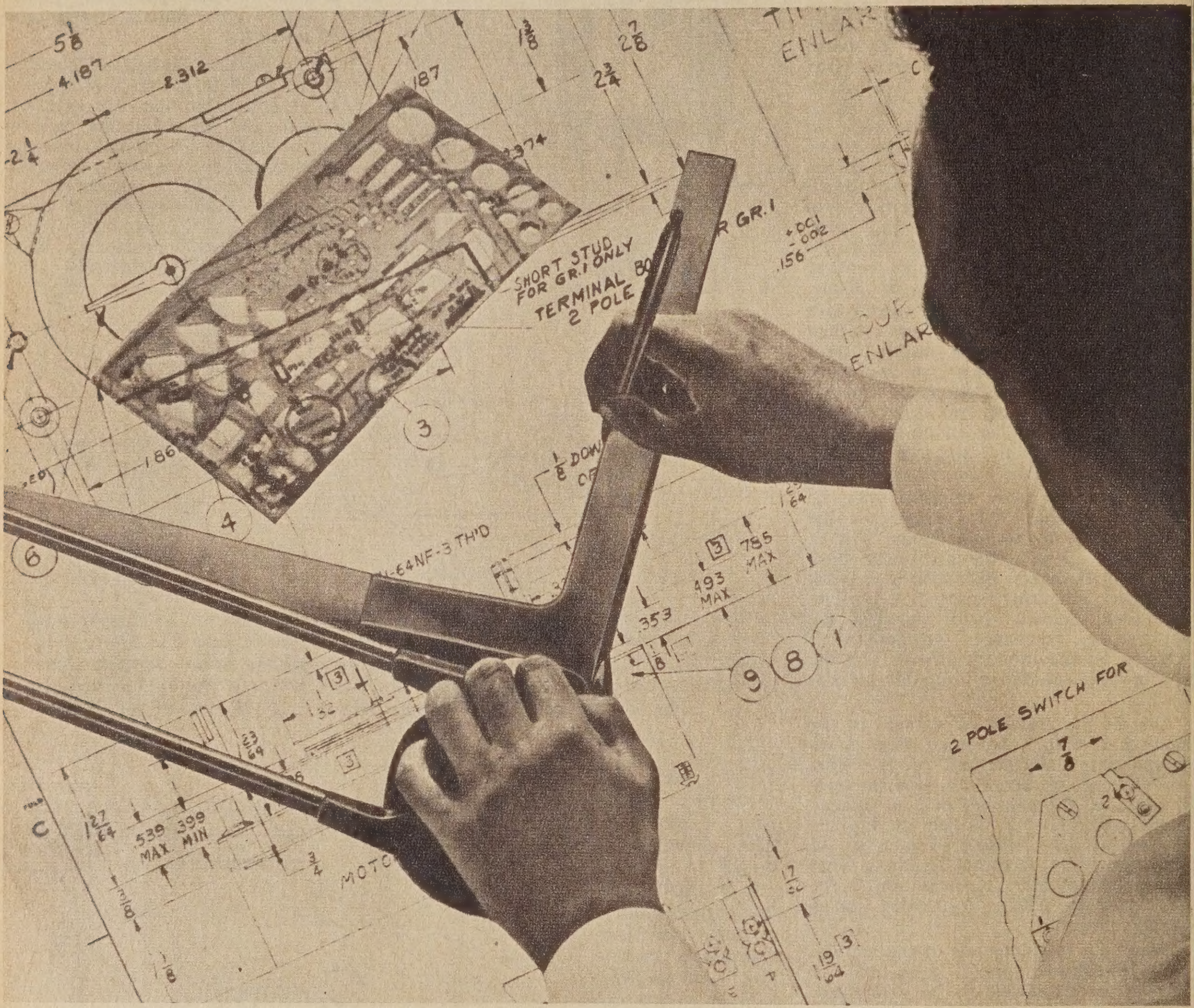
Dr Willis devoted himself to the solution of the problems of medical applications of atomic absorption. For example, hospitals meeded to determine calcium in blood or in saliva, a difficult problem in conventional spectroscopy. Another requirement was the measurement of lead in urine, in the treatment of cases of industrial lead poisoning. These and many other problems were cleared up very elegantly, and the methods devised have become routine in major hospitals all over the world.

When the major problems had been solved, "Operation Backyard," as it was called, commenced. As there were many laboratories, mainly in Australia and New Zealand, which wished to use atomic absorption and no commercial apparatus was available, the C.S.I.R.O. approached a number of small local manufacturers to make bits and pieces of equipment, which were recommended as a "Do-it-yourself" kit to propective users.

But this could not keep up with the growing demand and, as many of the early "headaches" had disappeared by now atomic absorption went "commercial," and began to be manufactured in Australia. Two firms, Techtron and Ransley Glass co-operated, and after early vicissitudes began to turn out first-class apparatus.

Techtron, formerly in the electronic field, produced the diffraction monochro-

New SCR is so low-priced, you can use it even in lower-cost automotive and appliance circuits



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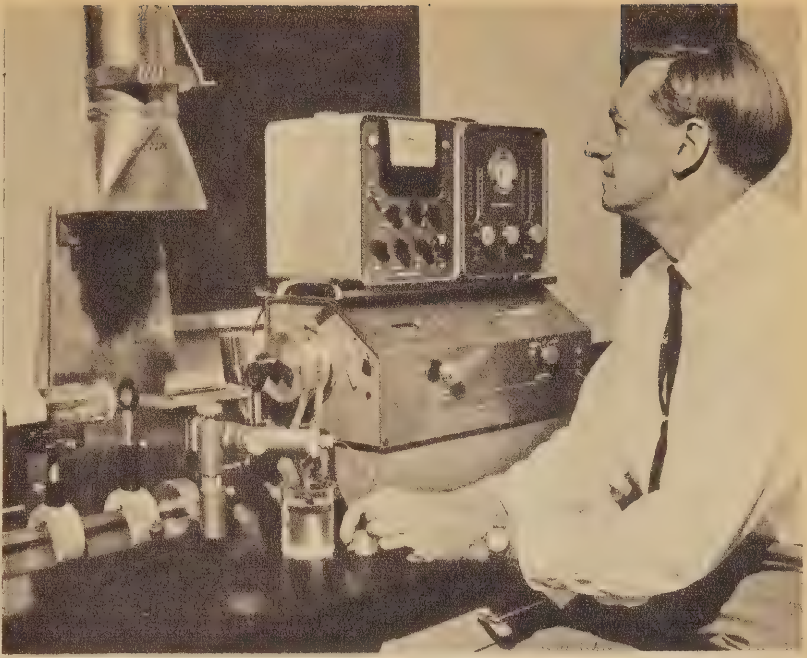


Figure 13: Dr Alan Walsh, of the C.S.I.R.O. Division of Chemical Physics, with an early commercial version of atomic absorption, manufactured by Techtron in Australia. The hollow cathode lamp, flame, monochromator and WMA are clearly seen; on top of the monochromator are the hollow cathode lamp power supply and controls for the flame and spray.

mator named "Siro-Spec" to another C.S.I.R.O. design, and looked after the electronics and atomizers; Ransley Glass formed a new company, Atomic Spectral Lamps Ltd and handled the ticklish business of making the hollow-cathode lamps.

Australian industry was quick off the mark as a user of atomic absorption. The speed of analysis, compared with the former wet-chemical methods, appealed to metallurgical firms, as does the simplicity and sensitivity of the method. (The Agriculture Department of Sydney University holds the record with 1700 analyses on one spectrometer in one day!) As physicist Walsh says, "It is difficult for the apparatus to be put out of adjustment — even by a chemist!"

John Lysaght, B.H.P. and Conzinc Riotinto of Australia, were among the earliest big users, at a time when the rest of the world had to be convinced. The applications grew daily — besides the mineral, metallurgical, agricultural, medical and food applications, atomic absorption has been applied to the servicing of diesel railway engines. The sump oil is checked frequently and, when a particular element begins to increase in concentration, the mechanics look at the appropriate part of the engine. For example, an increase in lead means that excessive wear is taking place in the bearings.

Strangely enough, the U.S.A. was rather slow to adopt atomic absorption, which prompted Dr Walsh in a lecture which he gave on one visit there, to refer to the U.S.A. as "an underdeveloped country." His audience retorted that there was nothing wrong with the U.S.A. which could not be put right by a massive aid program from Australia!

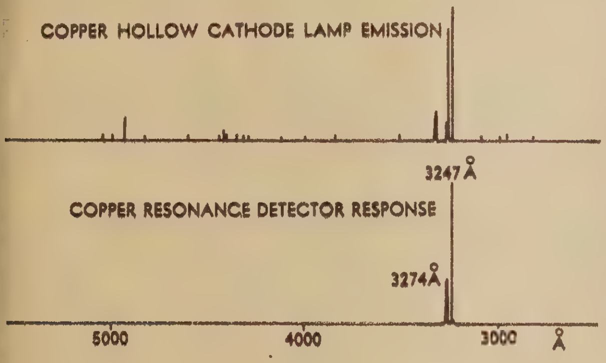


Figure 11: A number of lines are emitted by a normal hollow-cathode lamp, not all being "resonance" lines. Using a resonance radiation detector, the light from resonance lines at 3274 and 3247 Angstroms are detected, and other lines ignored.

For many elements one part in one hundred million can now be detected. It is basically this type of atomic absorption using the simple hollow-cathode lamps, which accounts for the present 1500-2000 instruments, some of them home-made by scientists, which are at present in use all over the world.

An interesting map in Dr Walsh's office used to show with coloured pins places which were known to be using atomic absorption, but the Division can no longer afford the pins necessary to keep pace with the spread of atomic absorption!

But even these methods of atomic absorption have become "old hat" owing to three new inventions. It's really hard to keep up with this game!

The first, produced by Mr J. Sullivan and Dr Walsh, is a new type of hollow-cathode lamp, with about 100 times the light output of the older type of lamp, which has now reached the point of commercial manufacture in Australia. Not only is this new lamp more powerful, allowing about a 100-fold increase in the sensitivity of detection, but it very conveniently puts out almost all of its light output in the resonance line required, rather than in other lines as well.

Soon after this development came the "post-modulator," perhaps the most cunning of all the inventions in this field, and released in June, 1965, at the Fifth Australian Spectroscopy Conference at Perth, before an audience containing a large sprinkling of overseas atomic absorption workers.

It is best seen in Figure 9, which shows essentially one of the high-intensity hollow-cathode lamps, and a conventional lamp arranged collinearly in the one glass envelope. The low-intensity lamp is run off an AC supply; as the density of the cloud of metal atoms in the hollow-cathode depends upon the current in the lamp, the density of atoms in the low intensity lamp fluctuates with the frequency of the AC supply. Resonance light from the high-intensity lamp is absorbed strongly when there are a lot of metal atoms in the hollow-cathode and less strongly when there are fewer atoms. Thus the AC low-intensity lamp acts as a modulator of the high-intensity light.

The big trick is that it modulates only the appropriate resonance radiation, and not the other spectral lines and, as the AC amplifier amplifies only the "AC" component of the light, the other lines are ignored. In many cases it is then unnecessary to use any other method of separating the spectral lines and so a monochromator is unnecessary!

Yet another type of "separator" of the resonance radiation has been devised. Figure 10 shows it all, and the principle is simple. In this case another low-powered hollow-cathode lamp is used as the detector. It takes a bit of getting used to this topsy-turvy type of specroscopy!

The hollow-cathode detector or "resonance detector," as it is now called, produces a gas of appropriate metal atoms near the mouth of the hollow-cathode and these can act as absorbers of the incoming resonance light, but not of any other wavelength. These atoms then reradiate the absorbed light in all the directions with an intensity proportional to that of the incoming resonance radiation and the re-radiated light is detected with a photocell. In this case there is literally no need for a monochromator, which takes a conventional spectroscopist a little time to get used to! Figure 11 shows the dramatic effects achieved.

Production of an instrument for this type of work is just getting under way in Australia and Figure 12 shows a prototype commercial version of this very unusual instrument for atomic resonance spectroscopy.

Of course, there are many other developments taking place in this rapidly growing field. One by-product has been the production of super-hot, yet safe,

(Continued on Page 128)

H.M.A.S. Perth recently indulged in exercises in which it theoretically located and shot down a number of enemy planes using its Tartar missiles. In fact the missiles never left the launcher and a large part of the exercise was simulated electronically.

SIMULATION—Saves lives and money

One of the more recent developments in electronics is the technique of simulation: the generation of artificial signals representing non-existent but perfectly feasible physical phenomena which are either too expensive, too inconvenient, or too dangerous to initiate in real life.

In the present complex state of our technology there are a great many devices, or combinations of devices, which require an extremely high level of human skill and training to handle yet, by their very nature, make it extremely difficult to acquire such skill and training.

Aircraft, and the modern airliner in particular, present a classic example. It is essential that an aircraft pilot be taught to respond instinctively and automatically to virtually any emergency with which he may be confronted.

But how do you teach a pilot to respond correctly to a dangerous situation without actually creating the situation? And if the situation is created and the student responds incorrectly how is a real accident avoided?

At one time the answer was something of a lemon. Everyone concerned did the best they could in an effort to strike an acceptable compromise between safety on the one hand, and sufficient realism on the other. At the best it was a long and expensive business, with little real guarantee that any one individual would be completely equal to the real situation should it arise.

And, quite apart from the safety angle, cost is a vital factor in such training. Modern airliners are costly things to run, if only because they need to work as many hours of the day as possible in order to pay their way. While ever they are not carrying passengers or cargo, they are losing valuable revenue. Thus flying an airliner simply for training is a very expensive business.

The answer, more recently, has been the flight simulator; a dummy cockpit equipped with all the controls of a real aircraft and which, by means of suitable external mechanisms, cause all the other instruments, and the cockpit itself, to respond just as in a real aircraft.

One of the first such simulators was the now historic Link Trainer. This used simple mechanical couplings from the controls and elementary pneumatic bellows to control the angle of the cockpit. While crude by modern standards, it represents the beginning of a rapidly expanding technique; that of providing realistic ways to simulate dangerous or expensive situations for purposes of instruction.

The modern flight simulator is a far cry from the old trainer. Complex analogue and digital computers accept the signals from the controls and are programmed to generate new signals representing what would happen in reality. Thus the cockpit pitches and rolls in exactly the same manner as would the real aircraft, taking into account the type of aircraft, its supposed speed, altitude, etc., plus any malfunction an instructor may care to simulate.

For added realism there can be a colour TV system to give the pilot an accurate view of a typical airfield on which he must land, sound and vibration—even to the squeal of tyres and the bump as the wheels hit the runway—and pressure pads to simulate G forces in the seat of his pants.

But the technique of simulation is no longer confined to aircraft. Car simulators have been developed to assist traffic safety investigations and may eventually be used to produce better—and safer—car drivers. Locomotive simulators have also been developed, to assist driver training with increased safety and, as with aircraft, to avoid tying up revenue-earning rolling stock and track in training programs.

And this is only the beginning. From single vehicle simulators, involving only one or two persons and often a minimum of co-ordination between them, engineers are now producing simulators for the armed services which can reproduce complete "war games," such as a naval battle, providing realistic tuition at every level from the radar plotters who must correctly identify every blip that appears on their screens, right up to the commanding officers who must make the correct tactical decisions.

The following story, reprinted by arrangement with "Sperryscope," published by the Sperry Rand Corporation, describes such an installation as supplied to the Royal Canadian Navy. The story was written by Commodore H. G. Burchell, R.C.N., Director General of Fighting Equipment.

The Royal Canadian Navy, charged with an anti-submarine warfare role for NATO, is training operations room crews by simulating battles electronically. Before the introduction of this system, there were many problems that could not be overcome on peacetime budgets. To conduct an actual exercise requires putting a fleet to sea; and this certainly cannot be done frequently enough to give operators a thorough familiarity with the operation of their equipment under battle conditions, let alone to train them in tactics. These problems were made more severe by the Royal Canadian Navy's experience of having put its anti-submarine fleet to sea on an exercise only to have to call the exercise off because of bad weather.

The R.C.N. enlisted the help of Sperry Gyroscope Company of Canada, Ltd., and the result was the Tactical Training Set now in operation at the Operations Division, Fleet School, H.M.C.S. Stadacona, Halifax.

The trainer is based on the fact that modern anti-submarine warfare is conducted, not from the bridge, but from an operations room in the heart of the ship. Here, electronic devices find the hidden enemy beneath the sea and detect aircraft and missiles flying too high for the eye to see. The staff of an operations room see friend and foe only as signals on their radar and sonar sets, and plot the battle from these signals.

From this it is obvious that one would not need ships or aircraft at all for some training purposes if it were possible to simulate signals which, on the operators' sets, exactly resembled ships and aircraft in both size and movement.

This is what Sperry Canada has done. It has provided the Royal Canadian Navy with 32 simulated targets—either friend or foe—that are fed into standard naval detection equipment. These targets represent fixed-wing aircraft, helicopters, missiles, destroyer escorts, aircraft carriers, and submarines. The accuracy with which those targets are portrayed is illustrated by the fact that the submarines can be shown as submerged, surfaced, or snorting (snorkeling). The latter refers to the time when the submarine remains below the surface of the water to draw in air and expell exhaust gases through a tube called a snorkel.

At Halifax the trainer represents the air direction room of an aircraft carrier and the operations rooms of four destroyer escorts. These rooms are, as near as possible, exact replicas of the operations rooms of actual ships. Each of these ships controls its own movements and detects all other targets relative to its own position.

Apart from these five ships, all other targets are controlled from the main control room, and here a permanent film record is made of the battle and simultaneously projected on to a screen. This large projected display shows, in the form of tracks and identifying symbols, all targets operating within a 100-, 25-, or 12.5 - mile - square area selected from the 500-mile-square playing area. During debriefing, this film is viewed by everyone who took part in the exercise—an advantage that an exercise at sea could never provide. It is also possible to "freeze" the electronic exercise at any time for discussion.

In addition to the projection of the exercise, the control room staff is provided with extensive monitoring facilities to help it control and co-ordinate the exercise. A cathode-ray tube display shows all aircraft targets in the battle area, together with identifying information. Another cathode-ray tube gives a large-scale presentation of a selected smaller area for close control of helicopter operations and close-range tactical manoeuvres.

Further information is given to the control room staff in the form of digital symbols, dials, and lights. This information includes speed, course, and mode of each ship target; speed course and altitude of each air target; course and speed of own ships; range and bearing of possible sonar targets; and relative ranges and bearings between selected targets.

Data provided to staffs of the destroyer-escorts'operations rooms consist of radar information (including jamming, noise, and sea clutter); ships courses and speeds (fed directly to plotting tables and compass repeaters); and sonar bearing and distance of selected targets. Communications are also provided via simulated radio, broadcast, and command circuits.

Target data are generated at eight target control consoles. The target data generated include the speed of each target, the sine and co-sine of the course angle, the initial co-ordinate positions and pre-set fade range, and various digital inputs such as IFF (Identification Friend or Foe) modes, altitude, helicopter hovering on-off, aircraft slaving to ships on-off, and so on.

All this information is fed to a computer which performs all calculations and a large number of logical functions. From the target speed and course data, together with inputs from a real-time clock, the computer recalculates the position of every target at approximately three-second intervals. The computer also calculates the relative ranges and bearings of every target from each of the four own ships and relative ranges and bearings between other targets on interrogation by any of the controller's consoles.

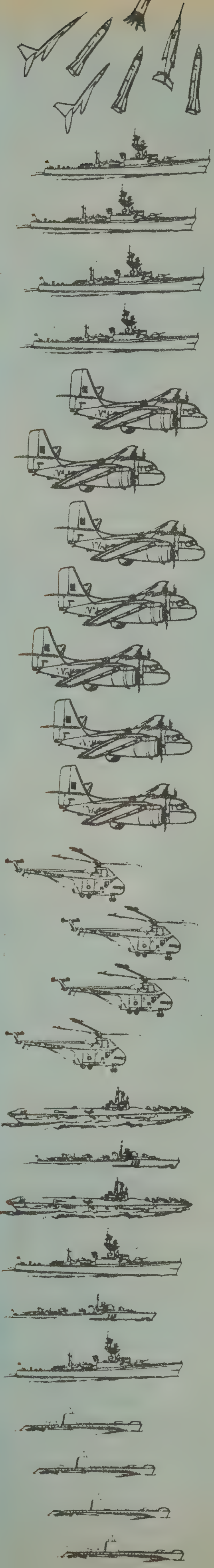
The computer checks relative ranges for all targets from the four own ships against radar coverage parameters to determine whether or not targets should appear on radar presentations.

All this means that, to the men in the operations rooms of the tactical trainer, the battle seems real in every dimension —except for the roll of the ship.

The tactical trainer is extremely versatile. It can be used for war games, in which the commanders of each of the four destroyer escorts have to make fast and accurate decisions as the battle evolves. It can simulate specific situations to see how well the commanders respond. It can be used to train operations room staff in the use of their equipment, or it can be used to evaluate new equipment.

By virtue of its flexibility, high accuracy, and ease of operation, this equipment has provided the Royal Canadian Navy with a training system, the full potential of which has not yet been completely realised.

Certain design requirements have been exceeded, largely because of the digital method of computing target movement. For example, high-speed aircraft targets can be accurately controlled at low speeds. This makes it possible to use them to simulate helicopters, surface ships, or even land areas.



Thirty two targets, ranging from submarines to missiles can be simulated with the Tactical Training Set used by the Royal Canadian Navy.

— AND ACROSS THE ATLANTIC

In Britain, the Royal Navy is adopting a similar approach to training problems. At a recent ceremony at the Farnborough headquarters of the Solartron company a £500,000 digital "war games" simulator was formally handed over to the Navy. It is to be installed at H.M.S. Dryad, the Portsmouth shore establishment.

Described as the first digital equipment of its type to be developed and built in Europe, it is believed to be the first to combine three separate training operations within a single system.

The Surface Tactical and Blind (H.M.S.) Pilotage Trainer provides facilities for either separate of simultaneous exercises for (1) teaching basic operator skills such as radar reporting and plotting, (2) training of weapons direction and control beams, and (3) Command tactical training in which the Command is given processed information on which to base its decisions and the simulated communications for their implementation.

At H.M.S. Dryad the Navy will use the simulator for training in blind pilotage navigation, fleetwork and manoeuvres, as well as tactical training of Command teams.

To combine the facilities of a radar simulator within a large tactical trainer demanded high speed data handling capacity with high accuracy, and for the central processor Solartron developed their own special purpose digital computer. It was specifically designed to derive from any two true positions the relative range and bearing in less than 15 microsecs. Essentially a cartesian polar converter, it continuously updates all cartesian positions and rapidly cycles to establish relative polar coordinates.

Computer addition time is one microsec and with a store cycle time of two microseconds, and it has a built-in program. The computer and other central equipment such as echo generators, resolvers, symbol generators, etc., are housed in a series of 20 nine-foot racks.

Facilities provided by the trainer include:

(1) Six radar-carrying ships. Characteristics such as speed, acceleration, turning circle, etc., can be varied to simulate surface vessels or submarines of differing type. The radar picture from any one ship shows all other ships and targets within radar range, and radar scanner height is adjustable to provide different detection ranges. Each "ship" is provided with its own high-accuracy coastline generator.

(2) Eighteen mobile targets which can be ships, aircraft, helicopters or submarines. All these craft are steerable with speeds up to 1,000 knots, and variable height where appropriate.

(3) Six fixed targets which can represent buoys or other sea marks.

(4) A playing area with sides 200 nautical miles long, and a positioning accuracy of 30 yards.

The outputs from each radar carrying ship are fed to a separate operations room model where they feed the surface radar displays, automatic plotting tables and course and speed indicators. The extensive control and display equipment includes a large-scale general situation display, tactical display expansion facilities, on-demand display of range and bearing between any two tracks, tactical displays.

("Electronics Weekly")

Another story written by William Clothier in a recent edition of the Boeing Magazine, tells of an equally spectactular use for simulation in quite a different field—space travel. Here entire space flights are simulated in computers to provide realistic data for astronauts undertaking simulated space flights.

For months researchers in Boeing's Space Division have been using computers to fly simulated missions to Mars, Venus and other planets. By a Monte Carlo technique engineers calculate probability of mission success and focus attention on those parts of the spacecraft system which need additional development.

In Monte Carlo simulation, each mission function is acted out on paper. The launch vehicle either lifts off or it doesn't and the sequence of following events depends on which occurs.

During early test runs in 1964, 200 missions to Mars were flown on the computer in a typical simulation using data obtained from actual rocket launches and from research programs. Only one launch vehicle and one spacecraft were available per mission. When the 200 flights were finished tabulation showed that 193 spacecraft were placed in earth orbit, 33 spacecraft were injected into Mars orbit and 10 spacecraft completed six months in orbit around Mars.

Obviously there was room for improvement in mission success ratio. The simulated flights helped define trouble spots. Improvements were made in recent simulated runs and as a result showed 95 successful missions out of 200 launches.

There is historical precedence for such a ratio. In 1964 the National Aeronautics and Space Administration launched Mariner III and Mariner IV toward Mars. Mariner III failed but Mariner IV's photographs of Mars created a scientific shockwave on Earth.

When the results of Boeing's computer flights to Mars are converted to two launch attempts per mission — as with Mariners III and IV — the probability of a successful flight by one of the two spacecraft is increased from 50 to about 75 per cent.

Success ratio of simulated flights can vary, depending on mission objectives and constraints. Boeing engineers hav designed several mathematical models space exploration systems for compute borne flights, with particular emphas on a Mars probe. Each step of the mi sion is programmed as part of a log diagram.

Frank Burns, of the launch and spa systems operation analysis group, sa the major operations of a typical inte planetary mission can be divided int four functions: prelaunch operation, i cluding assembly, checkout and coun down; booster-lift-off and injection int an earth parking orbit; injection int trajectory towards Mars, Venus, Me cury, Jupiter or another planet, wit mid-course corrections and data colle tion during cruise toward the targ planet, and planet encounter, injectio into planetary orbit and collection an transmission of data back to earth.

Other major operations can be pr grammed if the spacecraft includes capsule which must be landed on th planet.

A logic diagram is designed as a ste by-step procedure, each action decisio depending on success or failure of th preceding operation. If the launch is suc cessful, stage separation and an eart parking orbit come next. If the launc fails the logical action is to see if ar other launch vehicle is available. A alternate launch pad also may be re quired. If another launch pad is nc available, a decision for pad repair mus be made, if required. If an alternate pa and launch vehicle are available, assemb ly, check-out and countdown begin again.

Back up systems on the spacecraft ar programmed to recycle key operation such as solar panel deployment, attitud reference or mid-course corrections. Th mission is terminated if a key failur cannot be corrected.

The computer flights use informatio about the effects of solar and cosmi radiation on spacecraft components, th damage that meteoroids might do t spacecraft and the operating advantage of solar cells, solar batteries or nuclea energy as a power source. This information comes from studies conducted b Boeing and other companies for NASA

Recent study results show the probability of a successful boost into an earth parking orbit are about 96 per cent.

The chance of no meteoroid puncture is estimated to be 99 per cent for typical mission to a nearby planet. Damage from meteoroids depends to a larg extent on the time a spacecraft is exposed to possible hits. Indications are that the danger of meteroid punctures are not as great as once believed, bu studies are continuing. During 1965 NASA launched three Pegasus satellites to help determine the frequency and size of meteoroid strikes in near-earth space. Data also is available from the Mariner IV flight to Mars.

The probability that spacecraft subsystems will operate as intended for a entire mission (assuming successful boos and no meteoroid punctures) is abou 25 per cent if there is no redundancy i the spacecraft system. If there are back-up systems and if recycling procedures are provided for on board the vehicle this probability goes up to about 62 pe cent.

Finally, the probability of complete success for unmanned missions (including successful boost, no meteoroi

(Continued on Page 51)

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Trade-in prices at Encel Electronics are now at an all time high . . . so write for an EMQ or a trade-in valuation on your old amplifier.

KELLY SPEAKERS

Now a subsidiary of the Decca group, the Kelly organisation has increased production to satisfy world-wide demand. The resources of the Decca company assure increasing supplies and spares if ever required.

The new Mk. V 12in Bass Speaker. Total Flux: 250,000 Maxwells. Bass resonance: 25 c/s. Performance in small enclosures is excellent. Designed for use with the Kelly Ribbon Tweeter, the frequency response of the Mk. V has an upper limit of 5 kc/s. **$45.**

Kelly Ribbon Tweeter Mk. II. Regarded as the most advanced domestic tweeter available, the Mk. II is priced at only **$39.** Crossover to match, **$11.**

Encel prices have been fixed to provide high quality at reasonable costs.

STENORETTE DICTATING MACHINES

Complete with cassette, foot control, microphone, real and earphone. Retail **$151.50.** Encel Price: **$179**

GRUNDIG TAPE DECK SPECIAL

Brand new TM45 tape decks, as used in the Grundig TK46, which retails for **$480.** These decks retail at **$241.50. ENCEL SPECIAL PRICE:** **$171**

WHAT IS AN EMQ!

Many prices cannot be advertised, so we advise you to write for an EMQ — an Encel Mail Quote. When asking for prices on tape recorders and amplifiers we can supply your EMQ more easily if you provide us with an idea of the facilities and features required. Please give us your full address printed in BLOCK LETTERS.

Improve H.F. Response with Celestion!

The Celestion HF 1300 tweeter is patterned on the famous GEC BSC 1852 unit, as used in BBC studios. Frequency response is level within plus or minus 2 db from 1500 c/s to 13 kc/s, and extends well over 15 kc/s. The HF 1300 is simply connected via a 10 mfd capacitor which is supplied with the tweeter **free of charge.** Price **$15.**

DICTATING MACHINES NOW IN STOCK

Philips 3582, Stenorette LWE, Olympia.

ACOUSTECH AMPLIFIERS

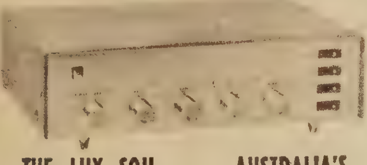
Acoustech equipment is regarded as the finest in the world — leading international reviewers use them in their personal equipment. The first shipment sold out quickly! Write for prices and technical specifications.

SPEAKERS NOW IN STOCK

Celestion, Kelly, KEF, Wharfedale, Leak, Goodmans, Richard Allen, Stentorian, Philips, National, Rola, etc.

KEF "Celeste" Speaker Systems

Now fitted with a new Super Tweeter, the KEF Celeste is better than ever! Write for an EMQ.



THE LUX SQII . . . AUSTRALIA'S MOST POPULAR SOLID STATE STEREO AMPLIFIER

Users everywhere report excellent performance with this fully transistorised stereo amplifier. Input sensitivity is 4mV, output is 20 watts in each channel. Features include: Loudness control, scratch and rumble filters, separate bass and treble controls, etc. Send for full details. Similar quality is usually twice this price! **$139**

ENCEL X1212 STEREO AMPLIFIER

The new Model X1212 features an input sens. of 4mV, an output of 12 watts RMS in each channel and a frequency response of 30 — 50,000 c/s. Although many improvements have been incorporated, the price is now only **$85**

TAPE RECORDERS

Advertising our tape recorder prices is forbidden; sufficient to say that Encel tape recorder sales are at an all time high! Write for your EMQ! Stock now includes: Revox G36, two and four track; Tandberg 64 and 74B; Beocord 2000 and 1500; Akai M8, X4, 355, 1700; Sony 500a, 200, 357/4, etc.; National 703S, 705, 755S; Philips EL3548, EL3549, EL3301, Ferguson; Truvox and many more. **TAPE DECKS.** Write for prices of Collaro, Sony TC250A and Grundig TM45 tape decks.

TURNTABLES NOW IN STOCK

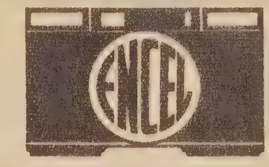
Orpheus, Labcraft, Garrard, P.E., Lenco Thorens, J.H., Dual, etc.

SPEEDY MAIL ORDER SERVICE

When ordering please give your full address, printed in BLOCK LETTERS. Equipment is carefully packed to ensure safe delivery. Normal parts and labour guarantees apply to all Encel equipment, and prices quoted in this advertisement **INCLUDE SALES TAX.**

ROLAND FAX 150 STEREO AMPLIFIER

This popular stereo amplifier incorporates a built-in AM and FM Multiplex. Write for an EMQ and specifications.



Many readers wrote to us concerning photographic equipment some months ago, and we sincerely regret our inability to carry all popular lines at that time. This section has now been enlarged, and most popular makes of cameras and projectors are now on display. All equipment is fully guaranteed, Write for prices and details.

PHILIPS MASTER RANGE SPEAKERS

All models now available: Minuette, Minstrel and Majestic. Write for EMQ's.

INTERCOMMUNICATION SYSTEMS

Several models available, "Eden" 7 station — $35.50. "Eden" 4 station — $27.50. "Gem" 3 station — $11.50. "Gem" 2 station — $9.50. Well known "Fountain" systems 7 station — $44.20. 4 station — $27.10. 2 station $14.10.

TOP VALUE COMPLETE STEREO SYSTEM

Linmark SA200 stereo amplifier, Labcraft 643 turntable with B & O magnetic stereo diamond cartridge, two Wharfedale 8in RS/DD wide range speakers. **$138.**

THE NEW CELESTION "DITTON 10"

Regarded as one of the most advanced compact speaker systems ever to be released, the Celestion Ditton 10 is available in either teak or walnut oiled finishes. Frequency response is 35-15,000 c/s. See the reviews in "Hi-Fi News," p. 433, Oct. 65: "Gramo" p. 41, June 6. Size of the Ditton 10 is only 12¾in x 6¾in x 8¼in. Encel Price **$59**

CELESTION "STUDIO SERIES" SPEAKERS

Both Celestion co-axial 12" models are proving very popular in Australia . . . and the price is more than competitive. The Standard Model CX1512 has a conservatively quoted frequency response of 30-15,000 c/s and is rated at 15 watts RMS. The Deluxe Model CX2012 (illustrated) has a frequency response conservatively quoted at 30-18,000 c/s and is rated at 20 watts RMS. Both models employ pressure type tweeters and feature an electrical crossover at 4 kc/s. See the reviews in "Electronics Australia," p. 131, Dec. 65, "Gramophone," p. 511, April 65, "Hi-Fi News," p. 75, June 65.

ENCEL PRICES

Standard CX 1512	$39.50
Deluxe CX 2012	$59.00

Cabinet construction details are available on request.

AMPLIFIERS NOW IN STOCK

Encel, Lux, Acoustech, Roland, Pioneer, Leak, Linmark, etc.

EXCLUSIVE ENCEL OFFERS FOR MAY

1. Mullard 6GW8 4 watts per channel stereo amplifier — in case, Labcraft 643 turntable with stereo diamond cartridge, two 8in Wharfedale speakers. An ideal budget system. Price **$110**

2. The new Encel X1212 or the Star SA30 stereo amplifier, Labcraft 605 turntable, J.H. tone arm, ADC 770 stereo diamond magnetic cartridge, two twin-cone 10in Wharfedale RS/DD speakers. (10in Stentorian/Richard Allen speakers at the same price). Price **$189**

*With the Sony TC 250a stereo tape deck (2 speeds) fitted with recording and playback amplifiers. Price **$328**

*With the Grundig TM45 3 speeds 3 head stereo tape deck, fitted with recording and playback amplifiers as used in the TK46. **$354**

3. Pioneer SMB 161 stereophonic amplifier with AM/AM/SW tuners, Labcraft 643 turntable with B & O stereo diamond magnetic cartridge, two Wharfedale 8in RS/DD speakers. Price **$195**

(Save $20 by using the Roland FAX 150 amplifier. If you prefer the Labcraft 605 turntable, All Balance arm and ADC 770 cartridge, **add $20.**

4. Leak Stereo 30 amplifier, Orpheus Silex turntable, ADC 40 tone arm, ADC .4E cartridge, two Celestion CX 2012 co-axial speakers. Price **$438**

5. Lux SQ11 solid state stereo amplifier, Orpheus Silex turntable, Ortofon SMG 212 tone arm, Ortofon SPU-GT-E cartridge, two Celestion CX1512 speakers. **$325**

6. Two Wharfedale Linton speaker systems, Labcraft 605 turntable, All-Balance tone arm and ADC 770 cartridge. **$215**

7. Orpheus Silex turntable, Pritchard tone arm, ADC 10 E cartridge. Price **$137**

8. Sansui Model 220 stereophonic amplifier with AM/FM/SW tuners, Dual 1009 turntable, ADC 770 cartridge, two Wharfedale 10 RS/DD speakers. Price **$278**

Make up your own combination and ask for an EMQ!

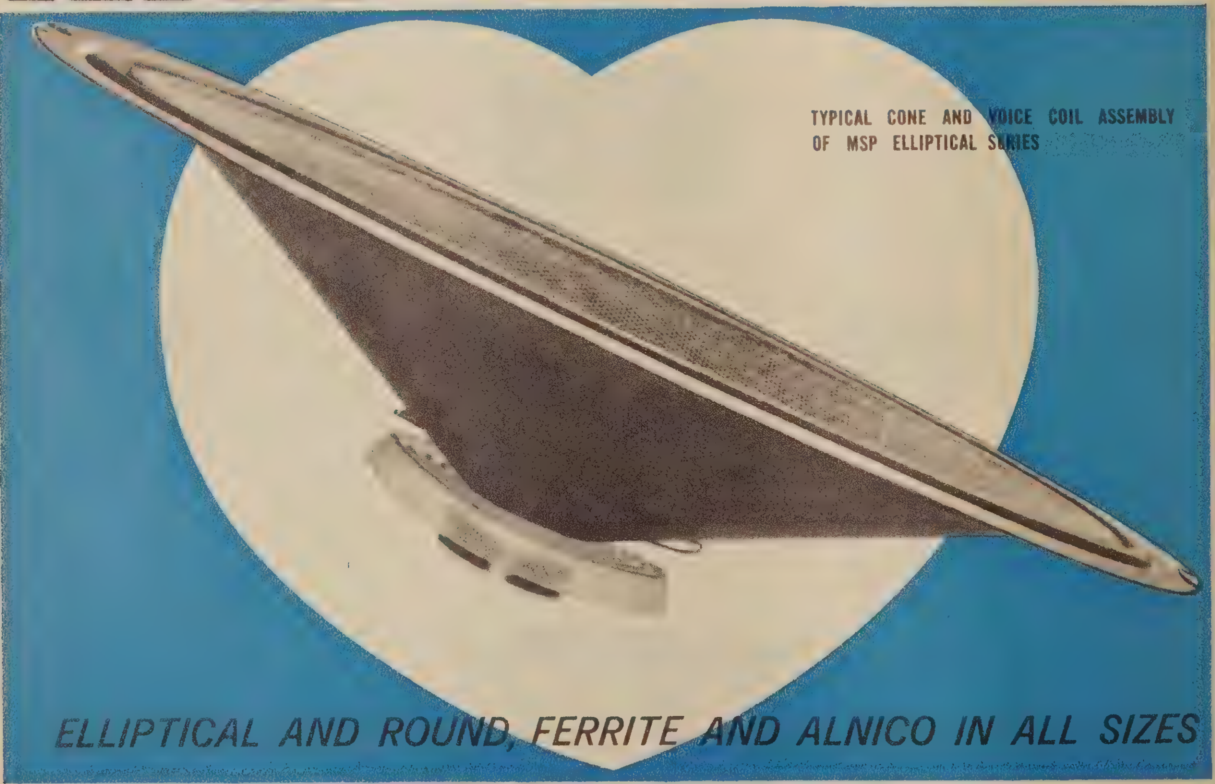
EARLY ENCEL SPECIALS AVAILABLE

The special offers made from time to time by Encel Electronics in "Electronics Australia" (Page 15) are kept open for several months. In the majority of cases, the prices quoted are still applicable. Please check with us!

Encel Electronics

Head Office:
431 Bridge Road, Richmond, Vic. Tel. 42 3762
City Branch: 18 Bourke Street, Melbourne. Tel. 32 2672

The CONE is the HEART of your MSP HI-FLUX SPEAKER



TYPICAL CONE AND VOICE COIL ASSEMBLY OF MSP ELLIPTICAL SERIES

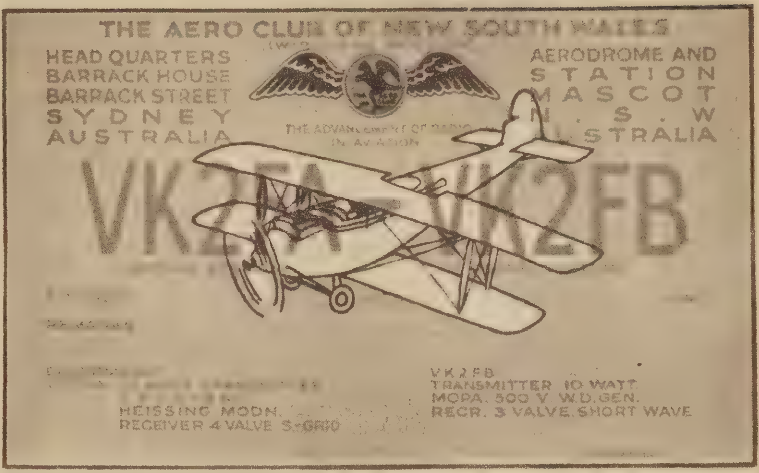
ELLIPTICAL AND ROUND, FERRITE AND ALNICO IN ALL SIZES

Kid gloves are not good enough for the handling of this **key** component of every MSP Hi-Flux Speaker — from the moment the **cone** is formed it is treated with meticulous care as it proceeds through an exacting series of tests and inspections. But the greatest care of all begins at the design stage when the exact cone shape and rim configuration are determined. Then comes the choice and blending of fibrous pulps for the sound characteristics to be achieved — next to be decided is the most suitable beating cycle which will turn the mix into the exact form required — then follows the decisive cone forming operation — but perhaps enough has been said already to convince you that MSP speaker cone design and manufacturing techniques are important reasons why this range has become **first choice in Australia.**

MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.
47 YORK STREET, SYDNEY – 2 0233

A PIONEER PASSES

One of Australia's most remarkable figures in the pioneering of radio and television in this country passed away in February at the age of 71 as unobtrusively as he had lived. His name was Sydney Victor Colville.



THE AERO CLUB OF NEW SOUTH WALES

HEAD QUARTERS
BARRACK HOUSE
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SYDNEY
AUSTRALIA

AERODROME AND
STATION
MASCOT
N. S. W
AUSTRALIA

THE ADVANCEMENT OF RADIO
IN AVIATION

VK2FA — VK2FB

HEISSING MOON.
RECEIVER 4 VALVE S-GRID

VK2FB
TRANSMITTER 10 WATT
MOPA. 500 V. W.D.GEN.
RECR. 3 VALVE. SHORT WAVE

The QSL card of the Aero Club of N.S.W., of which Syd Colville was nominated Honorary Radio Engineer after qualifying as a pilot in 1928.

This name would convey nothing to all but a few of the millions of television viewers throughout Australia, yet the following extract from a letter dated April 4, 1950, to Mr S. V. Colville, Colville Wireless Equipment Co. Pty. Ltd., Sydney, from the Director (A. R. Penfold) of the Museum of Technology and Applied Science (Sydney) records a unique achievement:

"The Trustees and I congratulate you upon the initiative and perseverance displayed in the construction of this first locally built television demonstration unit. We hope you will be rewarded for your pioneering effort when television attains commercial importance in Australia."

But it was typical of Syd Colville that he left the commercial development of television with its attendant publicity and glamour to others and turned his inquiring and imaginative mind to further experiments in the world of fast developing electronics. Subsequently he built what was probably the first high powered induction and dielectric heating equipment in Australia. He designed, manufactured and supplied this equipment for the Weapons Research Establishment, Atomic Energy Commision, Lucas Heights, the Queensland Railways, and other concerns.

Syd Colville was appointed radio engineer in the crew of the "Faith in Australia" for the first Tasman Air Mail crossing in 1932.

However, the greater part of his career was devoted to the development of radio, and his name is linked with the history of radio in Australia, from its earliest days.

Born at Kerang, Victoria, on March 22, 1894, Syd Colville was the second youngest of a family of nine. In 1900, on the death of his father, Robert Colville, a Scot who had settled in Victoria as a grazier, the family moved to Queensland. In 1911, at the age of 17, Syd Colville built in Brisbane the first amateur wireless station in Queensland, his call sign being XQF. At the same time he was doing a course in electrical engineering and mechanical drawing.

He founded the Queensland Wireless Institute in 1914 and was elected an honorary life member of that body in 1923. He was also a foundation member of the Institution of Radio & Electronics Engineers Australia, which he served as a Councillor and a committee member for many years. He was granted the Institution's Long Service Award in 1963 for long and distinguished service to the Radio industry.

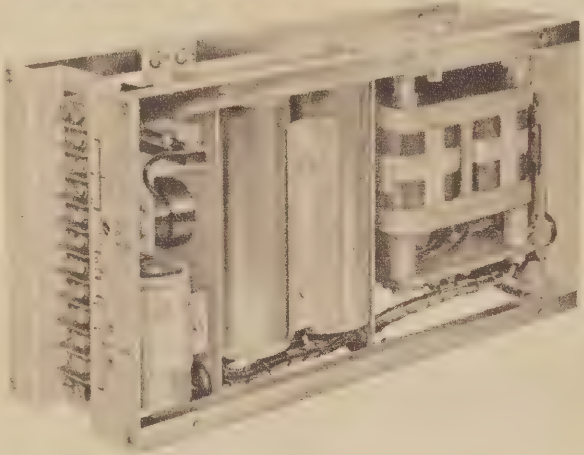
During World War I, he was active in military signals work and, in conjunction with the Post Office authorities in Queensland, did research work on valve amplifiers and repeaters.

In 1921, married and with a young family, he moved to Sydney and set up one of the first radio businesses to be established in Australia, Colville-Moore Wireless Supplies Ltd., manufacturers of Comovox Radio Receivers. This company later became Colville Wireless Equipment Pty. Ltd.

The early days of broadcasting owed much to the equipment designed by Syd Colville and also to his skill and know how. His call signs in Sydney were VK2FA and VK2FB at the time when

Advance

MODULAR POWER SUPPLIES
SERIES PM1 TO PM12



- **Modular Construction**
- **Fully transistorised**
- **All-silicon semiconductors**
- **Auto reset overload protection**
- **C-core transformers**
- **Series and parallel facilities**

The Advance PM' series of power supplies offer current ratings 1-10A at voltages which are preset between 7V and 50V. This, combined with their high stability, low output impedance, low ripple and economic cost make them particularly suitable for a wide range of applications.

Designed and engineered in the modular form of construction, the units are intended to be used as integral parts of other equipment, either singly or in multiples. They are fully transistorised, and the use of all-silicon semi-conductors permits operation up to 60°C. An overload circuit, with automatic reset, offers complete protection against short circuits and ensures the resumption of normal working when overload is removed.

All models are capable of being operated in series or parallel for higher power requirements, and whilst they are of open construction, the units can be supplied with a cover if required for bench use working.

SPECIFICATION

	OUTPUT				OUTPUT		
Type	Resistance	Current	Volts	Type	Resistance	Current	Volts
PM1	2 milliohms	0- 1 Amp	7-15	PM7	2 milliohms	0- 5 Amp	7-15
PM2	4 milliohms	0- 1 Amp	15-30	PM8	4 milliohms	0- 5 Amp	15-30
PM3	8 milliohms	0- 1 Amp	30-50	PM9	8 milliohms	0- 5 Amp	30-50
PM4	2 milliohms	0- 3 Amp	7-15	PM10	2 milliohms	0-10 Amp	7-15
PM5	4 milliohms	0- 3 Amp	15-30	PM11	4 milliohms	0-10 Amp	15-30
PM6	8 milliohms	0- 3 Amp	30-50	PM12	8 milliohms	0-10 Amp	30-50
	(0-full load)		(Min-7V)		(0-full load)		(Min-7V)

Stability:	Output V Input change — 1000:1
Temperature:	Co-eff. 0.02%°C: operating range 0-60°C.
Output:	pre-set to any 1V increment adjustable ±0.5V from front panel Impedance: 0.25 ohms at 100Kc/s Ripple: less than 1mV p-p at full load
Power:	240V ±10%, 48 to 450c/s

Prices from $74.50 (PM1)

Plus Sales Tax 12½% at F.O.R.

JACOBY, MITCHELL & Co. Pty. Ltd.
469-475 KENT STREET, SYDNEY (26-2651)

MELBOURNE:
15 ABBOTSFORD ST.,
NTH. MELBOURNE.
(30-2491-2)

ADELAIDE:
652 SOUTH ROAD,
GLANDORE. (53-6117)

BRISBANE AGENTS:
T. H. MARTIN P./L.,
WILSON HOUSE,
CHARLOTTE ST.
(2-1785)

PERTH AGENTS:
C. F. LIDDELOW & CO.,
252 WILLIAM ST.,
PERTH. (28-1102)

TASMANIA AGENTS:
K. W. McCULLOCH P./L.,
P.O. BOX 606G
LAUNCESTON (2-5322)

Farmer & Co. started broadcasting from the top of their store in George Street as 2FC. He was a foundation member and on the Board of B.S.L. — Broadcasters (Sydney) Ltd., which was the commencement of Radio 2BL.

A further interesting fact is that the first broadcast of a woman singing live on the air in Australia was made by Syd Colville's wife from their home in Drummoyne in 1924. The 66 feet of radio mast erected in the Colville's back yard became a well known landmark in the district.

In 1925 he was commissioned by Mockler Bros. of Bathurst to design and build — as reported in the magazine "Radio" of November 11, of that year — "2MK, the first broadcasting station to commence active operations in New South Wales outside the capital city."

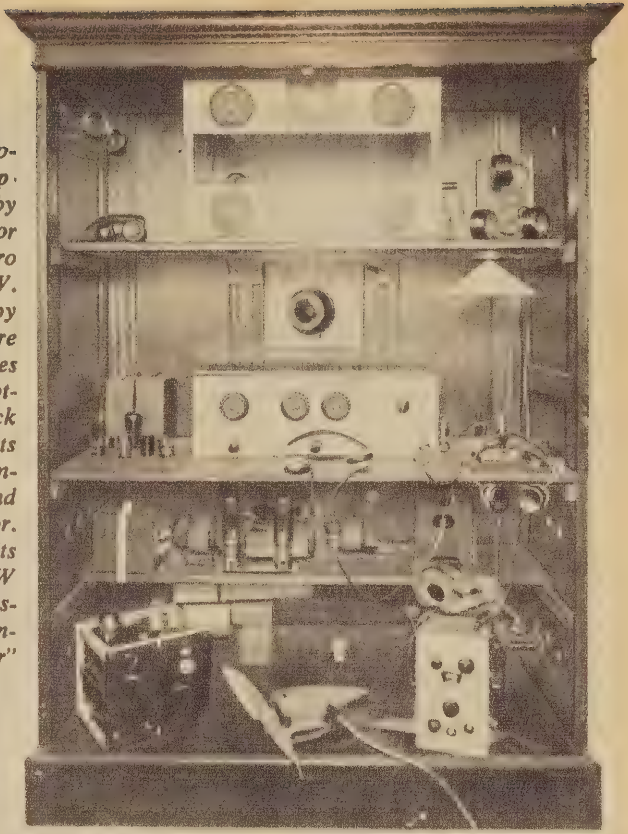
The magazine described the equipment in the following terms: "The overall input is 250 watts and the radio frequency input 50 watts. The circuit is the modified Hartley oscillator with Heissing modulation system, using Radiotron oscillator and modulator valves and Kenotron rectifier. Full wave, single-phase rectification through a well designed filter supplies an H.T. of very steady voltage. A 'Kellog' double button studio microphone is used and gives very satisfactory results, both in speech and music.

"The aerial is a five wire cage inverted 'L' type, 80ft top span with an 80ft tapered cage lead in. It is connected through the radiation meter to a three turn coil to a counterpoise of six wires, each 10ft apart and 90ft long. This circuit is inductively coupled to the oscillator and radiates a very sharp 250 meter wave."

In succeeding years he was associated with the designing and building of many more broadcast stations in Australia, particularly in Queensland where he was personally responsible for stations 4AY, 4IP, 4BU and 4GR.

Early in 1928 Prince Purachatra, Minister for Commerce and Communications in the Siamese Government and brother of the King of Siam, visited Sydney and approached Syd Colville to design and manufacture radio-telephony equipment for the Royal Siamese train and to supply the Siamese Army with short-wave intercommunication equipment. When the Prince and his Princess visited Syd Colville's home for a final demonstration of the complete equipment, they presented Mrs Colville with a very large and beautiful Blue Zircon. Syd Colville was subsequently appointed technical advisor to the Siamese Government.

But perhaps Syd Colville's greatest achievement was in the pioneering of radio communication in aircraft. This he undertook with a devotion which brought him into the flying game itself. He qualified as a pilot in 1928 and became Honorary Radio Engineer to the Royal Aero Club of N.S.W., then located at Mascot. These activities brought him into close contact as an advisor to such famous aviators as Sir Charles Kingsford-Smith and Mr C. T. P. Ulm and led to his being commissioned to build and install the radio equipment for the "Southern Cross" and "Faith in Australia," two Fokker aircraft piloted by Sir Charles and Ulm, names which have become legendary in Aviation history. For the first Tasman Air Mail crossing in 1932, Syd Colville was appointed radio engineer in the crew of "Faith in Australia."



Two-way radio-telephony equipment designed by Syd Colville for the Royal Aero Club of N.S.W. and supplied by Colville - Moore Wireless Supplies Ltd. At the bottom of the rack the airborne units can be seen complete with wind driven generator. The upper units are a 100W short wave transmitter and "International Four" receiver.

A further tribute to his success in this sphere is contained in the following extract from an article which appeared in "The Sun" on April 2, 1930, recounting the rescue of Dave Smith and Wally Shiers, who became lost in the wilds of North West Australia when attempting an Australia-England flight:

"For all time, the utility of correctly-designed radio emergency apparatus for aviation or any undertaking where humanity faces the possibility of isolation in Australia's vast spaces has been proved. In this instance, Mr Colville, aviator and radio engineer, most successfully applied his principles of design. By the help of such highly efficient apparatus the country has been saved heavy expense in what might otherwise have developed into a long search."

Smith and Shiers had been forced down with engine trouble into exceptionally long grass and could not be seen by the aerial search parties. Their radio signals, picked up 300 miles away, led to their speedy rescue.

In 1935, an even greater and more lasting tribute was accorded Syd Colville for his enterprise in land-to-air communication. A hitherto unchartered lake, Lat. 29 deg 30' Lngt. 125 deg 30', was named Lake Colville by its discoverer, Donald Mackay, O.B.E., leader of an aerial expedition into Central and Western Australia, in appreciation of services rendered. Mackay had commissioned Colville to design, build and equip his aircraft with radio. It was during a vital emergency in the air that this equipment particularly proved its effectiveness.

The 'plane was in danger of a forced landing in gibber country in the Great Victoria Desert when Colville's advice to the pilot was transmitted and received at a critical moment. The pilot was able to rectify the trouble and return safely to base. On this occasion Syd Colville's aviation knowledge proved to be equally as valuable as his radio equipment.

He was also connected with the Flying Doctor Service in the days when pedal wireless was used in out-back stations, and had a long contractual association with the Maritime Services Board of N.S.W. During World War II he was commissioned by the U.S. Navy to supply, modify and maintain its ships' radio communications while in Sydney.

In 1961 indifferent health forced Syd Colville into semi-retirement at which time Colville Wireless Equipment Co. Pty. Ltd., was merged with the British owned world-wide organisation of Pye Industries Ltd., specialising in induction heating equipment. He moved completely out of the business world in 1963 and lived in retirement at Glenbrook until his death on February 20 this year.

The esteem in which Syd Colville was held by his colleagues is exemplified by the fact that, although no longer active in the world of radio and electronics, he was one of the especially invited guests to the Dunrossil Memorial Lecture which was delivered by the Duke of Edinburgh for the Institution of Radio and Electronic Engineers in February, 1965. At the conclusion of the lecture Mr Colville was presented to Prince Philip. ■

Mullard
TRANSMITTING VALVES FOR SSB

ARE YOU DISSATISFIED WITH YOUR AM RIG?

With a suitable multi-band exciter followed by a linear amplifier selected from the range of Mullard Transmitting Valves listed below, you can join the growing ranks of sidebanders and get your fair share of DX!

LINEAR RF POWER AMPLIFIER SSB SUPPRESSED CARRIER SERVICE

Valve Type Number	V_a	$I_{a(o)}$	P (load) (driver)	PEP (out)
		mA	W	W
QV06-20	600	26	0.25	46
QV08-100	750	130	1.5	220
QV08-200	600	150	1.5	240
QV2-250C	2000	100	1.5	300
QY3-65	3000	15	1.0	130
QY3-125	3000	23	1.0	228
QY4-250	4000	50	1.0	454
YL1150	600	100	1.0	109

More detailed information on these valve types may be found in the Mullard Technical Handbook, Volume 3.

The following types are used extensively in SSB transceivers of American manufacture and are now available from Mullard for maintenance purposes—

6DQ5 6HF5 8236

Mullard-Australia Pty. Ltd.

35-43 CLARENCE STREET, SYDNEY, N.S.W. 29 2006
123 VICTORIA PARADE, COLLINGWOOD, N.5, VIC., 41 6644
Associated with MULLARD LIMITED, LONDON

YL1150

QV2-250C

M16

Technical Review

TV SCANNING TECHNIQUE USES LASER BEAM

An example of a line of research travelling in a full circle is to be found in the use of drum scanning (employed by Baird in England, Jenkins in U.S.A., and other pioneers of television) in an experimental TV system. No studio lights or other external sources of illumination are needed in the system, but picture quality is said to be exceptionally sharp.

Unlike conventional TV cameras, the Perkin-Elmer laser system uses no image orthicon or vidicon tube. The system instead uses a laser light transmitter and a reflected-energy receiver, both contained in a single unit. Intensity of the laser beam is well below the level which might endanger the vision of human subjects.

Although the present system is operable under conditions of low light or complete darkness, the technique could also be used in bright light with some equipment modifications.

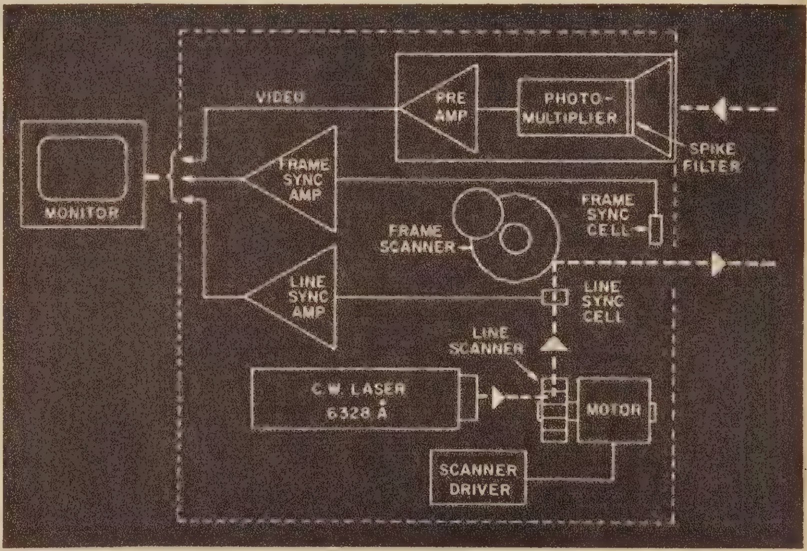
While the device may have specialised use in commercial TV studios, this application remains to be evaluated by industry experts. Because the light emitted from the laser TV camera comes from a single source, the lighting effects are similar to those of a photo taken with a flashbulb. The effect of many light sources from different angles is not possible with the present system. Laser scans from several different points are conceivable but might prove impractical from the standpoint of cost. Single-source illumination, however, may prove completely adequate for some uses such as "spot" TV news reporting.

In the present system, the light beam from a CW laser is deflected by a pair of rotating mirrors so as to completely scan the subject in a series of contiguous lines once every sixtieth of a second. The energy reflected from the target is sensed by a photomultiplier and used to intensity modulate the cathode ray tube in a television monitor whose electron beam is scanning at the same rate as the transmitted laser beam.

The laser used in the demonstration model is a helium-neon unit with approximately 15 milliwatts output in a one milliradian beam at 6,328 Angstroms. The beam from this laser is reflected off a folding mirror to the line scanner. This scanner consists of a 16-sided 1.5 inch diameter polygon prism mounted integrally with the scanner motor rotor. This motor, driven from a 2KC solid state power oscillator, drives the line scanner at approximately 60,000 rpm or 60,000/60 x 16 — 16,000 scans per second.

Following the line scanner the beam strikes the 24-sided frame scanner running at 150 rpm or 150/60 x 24 = 60 frames per second. The beam reflected off the frame scanner continues on toward the target. In combination, the line and frame scanners cause the target to be scanned at rates similar to commercial television, 15,750 lines/sec; 60 frames/sec. (U.S. standards. Editor). The one milliradian beam results in resolution similar to that of commercial television.

A portion of the laser energy reflected from the target is detected by an 11-stage photomultiplier with an S-20 photocathode. A 90 Angstrom spectral filter located in front of the photocathode rejects 99 per cent of the background light and precludes saturation from background. Following the photo-multiplier, a preamplifier with a gain of 26-dB and bandwidth of 5MC raises the signal to a level sufficient to drive the video amplifier of a commercial television set and intensity modulate the electron beam.



Block diagram shows light path from CW laser, from mirror scanner to subject, which reflects light back to photomultiplier tube.

The deflector circuits on the television monitor are synchronised with the scanning laser beam by means of photocells placed in the scanning beams. The line sync cell is located between the line and frame scanners so it is illuminated by the line scanner at the beginning of each scan line. The frame sync cell is located beyond the frame scanner so it is illuminated by the scanning beam at the beginning of each frame.

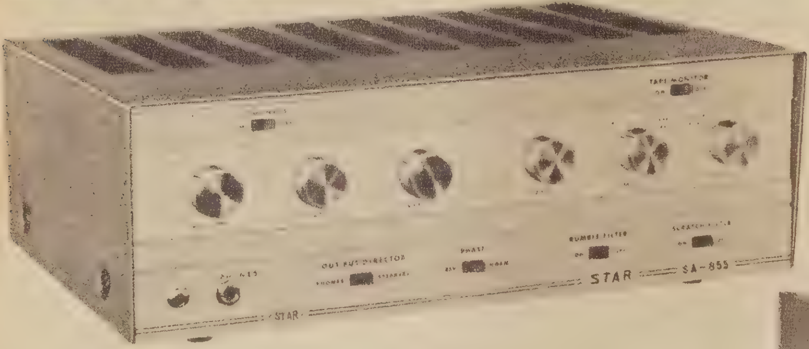
The output of the line sync cell is amplified and shaped in the line sync amplifier which generates 20-volt pulses to synchronise the horizontal deflection circuit in the television monitor. The output of the frame sync cell is amplified and shaped in the frame sync amplifier resulting in 20-volt pulses which are used to trigger the vertical deflection circuits of the TV monitor.

Laser TV has potential as a means of covert surveillance for law enforcement agencies. As used in the present system, the laser beam's fast scan speed and low intensity combine to make it virtually invisible, permitting the scanning of dark areas such as doorways at night without the knowledge of those observed. With a properly tailored system it would be possible to observe persons at distances of more than a mile. ("International Electronics", February, 1966). ■

THE FAMILY HAS GROWN

OUR NEW ARRIVAL IS THE

STAR SA855



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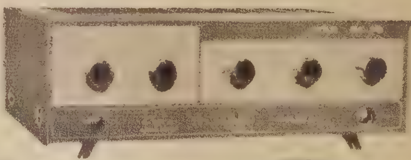

It was the Star SA30 that became the best seller over-night. The new STAR SA855 with 16 watts per channel gives you all that the famous SA30 offers PLUS these important new refinements.

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- ★ Power output 16 watts per channel
- ★ Loudness Control
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- ★ Tape Monitoring Facility
- ★ Better Noise Figure
- ★ Improved transient Response. Those transients associated with the very extreme dynamic range of your very best recordings are reproduced with ultimate fidelity with the SA855.

Specification SA855.
Maximum power: 16 watts per channel.
Response: 30-100,000 C.P.S.
Distortion: Less than 1% at 14 watts.
Sensitivity: For 16 watts per channel output at 1,000 C.P.S. Magnetic input of 3mv.
Hum & Noise: 72dB below 10 watts on magnetic input.
Tone Control: 50 c/s 7 dB boost or cut. 10,000 c/s 10 dB boost or cut.
Rumble Filter: 5dB down at 50 c/s.
Scratch Filter: 8dB down at 10,000 c/s.
Tube Complement: 3 x 12AX7, 2 x 6BL8, 4 x 6BQ5, 1 x 5AR4.
Dimensions: 15" wide x 11" deep x 5½" high (overall).
Weight: 23 lbs.
Power: 110 or 240 volt 50/60 cycles.
Equalisation: Magnetic input: RIAA
Tape head: NARTB.

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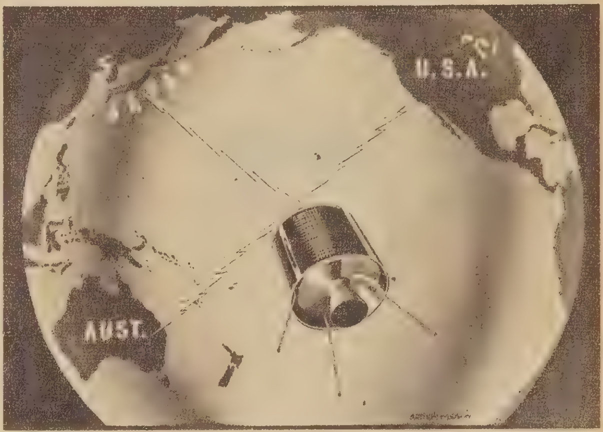
TRANS—PACIFIC TV VIA SATELLITES NEXT YEAR

New satellite launching to be carried out this year will establish an intercontinental communications network covering America, Australia, Europe and Asia and will enable Australia to take part in international television for the first time. The Overseas Telecommunications Commission (Australia) is investigating sites in the Eastern States for the Australian end of the link.



The satellites, known as "Intelsat Two," will be launched by the U.S. Space Agency from Cape Kennedy in August. They were originally ordered by the Agency to cover Project Apollo (the man-on-the-moon project) but the satellites have been provided with 180 channels surplus to the requirements of Project Apollo to give them a useful life as an international relay.

The satellites will be of the synchronous type, that is, they will follow the rotation of the earth, so that they will appear to be stationary in the sky when observed from Earth.

The proposed OTC relay station is expected to cost between $4m. and $6m. Although the technical facilities for the scheme are expected to be available in July, 1967, it is likely to be some time after that before negotiations relating to the charges for the use of the satellites and other commercial matters are completed.

Representatives of the countries expected to participate in the scheme discussed the plan at a conference held in Washington in March this year. At this meeting it was decided to establish bases for the Pacific area in U.S.A., Australia, Japan and Hawaii.

A further meeting will be held in Sydney later this year between representatives of the countries involved in the Pacific satellite scheme.

In addition to the "Intelsat" station, the OTC is constructing a communications station at Carnavon, W.A., which will be used solely in connection with space communications, and will be used for tracking and control of Project Apollo.

Some details of the satellites to be used in the Pacific area scheme were given in an article which appeared in the January 1966 issue of the Magazine "Space," from which the following is extracted.

The Communications Satellite Corporation (Comsat) recently awarded Hughes Aircraft Co. an $(US) 11,700,000 contract to build four new satellites.

The satellites' function is to provide satellite communications for the first time in the Pacific area and provide instant voice contact between the Apollo moon astronauts, the Space Flight Center at Houston, Texas and the various ground stations linked to the centre during Apollo's earth-orbiting phase.

Launch of the new satellite is scheduled for August, 1966, when the spacecraft are sent, separately, into synchronous equatorial orbits 22,3000 miles above the Atlantic and Pacific Oceans. The Atlantic satellite will be placed in space above the Ivory Coast of western Africa and the Pacific satellite will be positioned near the International Dateline. The global coverage of the satellites is expected to enable instant voice contact with the Apollo moon astronauts to be made directly from ground terminals in contact with the orbiting spacemen. These reports will be flashed directly to the National Aeronautics and Space Administration control centre in Houston, Texas.

Satellite communications with the astronauts will be continuous via ships and ground stations deployed around the world. An advanced satellite antenna design developed by Hughes will permit direct contact with several ground stations simultaneously and provide for greater commercial use without any degradation of loss of power in the transmitted signals, officials said.

Spacecraft design is based on the Early Bird communications satellite, which was successfully launched by the Communications Satellite Corporation April 6, 1965, and is now in commercial operation between the United States and Western Europe.

Weight of the new spacecraft will be 345 pounds at launch. The outer surface of the satellite will be covered with 12,756 N-on-P silicon solar cells which will deliver 100 watts electrical power under normal operating conditions.

The new satellite is a spin-stabilised synchronous communications satellite larger and heavier and with greater communications capacity than Early Bird.

The satellite will be 56 inches in diameter and 26¼ inches in height, exclusive of antennas and apogee motor nozzle. It will provide communication capability which will consist of multiple-access high-quality voice and digital data, television, or a combination of both.

John H. Richardson, Hughes senior vice-president and aerospace group executive, said the new satellites will have three times the transmitter power of Early Bird.

The additional power is used to add increased effective radiated power to provide greater geographical coverage. The greater weight is used in providing additional electrical power and a long life control system.

The spacecraft structure consists basically of a central-stiffened tube which directly supports the apogee motor and communications antennas. An aft radial bulkhead and rib assembly will support the majority of the payload electronics while a forward bulkhead will provide support for lateral and radial loads.

Both ends of the structure are closed by thermal shields and the shield at the antenna end also serves as the antenna ground plane.

Four travelling-wave transmitter tubes are provided which may be used in any combination consistent with the available power. The normal communications mode of operation throughout the satellite lifetime will be three tubes in operation, even during the eclipse period.

With the increased weight of the satellite — 160 pounds in orbit, as compared to the 85-pound Early Bird — the hydrogen peroxide fuel supply has been doubled.

The communications basic system consists of two redundant linear repeaters with 125MC bandwidth and 6dB noise figure and four 6-watt travelling-wave tubes of which 1, 2, 3 or 4 may be turned on in parallel. The transmitting antenna is similar to that on Early Bird except that it has a broader beam and is fixed and not folding. This reduces line losses and is a simpler, more reliable system.

The telemetry sub-system is also similar to that of Early Bird and consists of two encoders, the VHF transmitters, and eight whip antennas. The encoders modulate both the VHF transmitters and the 4GC beacon signals. As in Early Bird, both VHF transmitters can be commanded on or off, whereas the beacons are always on and modulated with telemetry signals. Telemetry will be transmitted by both 1.8 watt 136MC transmitters.

The satellite will be launched into orbit by the improved Delta rocket to be built by Douglas Aircraft Company. The spacecraft's self-contained propulsion system (the Aerojet General Pathfinder apogee motor) supplies the velocity boost to inject the satellite into synchronous altitude. The apogee motor will impart a velocity of 6050 fps to the 345-pound spacecraft for injection into the synchronous orbit.

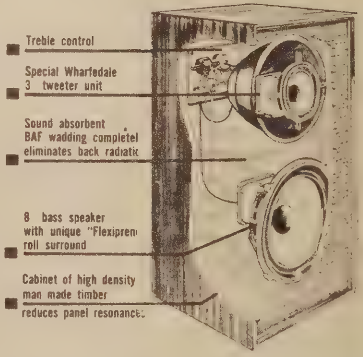
Which Compact Speaker System Offers Higher Sensitivity And Effective L.F. Performance?

The New Wharfedale "Linton"

Analytical appraisal of the development of miniature speaker systems reveals a compromise . . . the losses being in the lower registers and sensitivity. The new Wharfedale "Linton", although only 19" x 10" x 10", offers high fidelity sound reproduction with substantially linear bass response, excellent transient performance and high sensitivity due to the use by Wharfedale of large magnet assemblies. Two completely new Wharfedale units are featured in the "Linton" . . . an 8" bass speaker and a tweeter developed from the famous Wharfedale "Super 3". An entirely new roll- surround, Wharfedale Flexiprene, reduces the basic resonance of the woofer to only 43 c/s. Overall frequency response of the "Linton" is 40-15,000 c/s, power handling capacity 10 watts r.m.s. and impedance 8 or 15 ohms.

Styled by one of Britain's leading industrial designers, Robert Gutmann, the Wharfedale "Linton" cabinets are fabricated from low resonance man-made timber, finished in selected walnut or teak veneers. Lining is acoustic B.A.F. wadding to minimise cabinet resonances.

As world leaders in the field of sound reproduction, Wharfedale were reluctant to release a compact system until Wharfedale standards of sound were satisfied. Where smaller speaker systems are desirable, the new "Linton" offers fine performance standards designed to satisfy the most discriminating music lover. Listen to the new Wharfedale "Linton" today!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A.C.T.: Australian Physical Laboratories, P.O. Box 225, Canberra City. Tel. 4 3010 (Mr. J. E. Howe)
N.T.: Pfitzner's Music House, Smith Street, Darwin. Tel. 3801

MICROCIRCUITRY TO RADIO TELESCOPES

Representing the progress made in recent months in various fields of electronics in Britain, this selection of news stories show that British scientists and engineers are by no means falling behind those of other industrialised countries in the development of new equipment and techniques.

A new hot-gas microbonding technique for use in the production of microcircuits, and for similar applications, has been developed by G. V. Planer Ltd., Windmill Road, Sunbury-on-Thames, Middlesex. The system uses a stream of electrically heated and thermostatically controlled gas for bonding semi-conductor chips to substrate materials, attaching leads to electronic components and soldering wires to film circuits or semiconductors devices.

New hot-gas bonding technique in action.

Originally developed as an independent tool for the company's own research work, the system comprises equipment for producing a fine gas jet of heated nitrogen or a heated nitrogen-hydrogen mixture; a thermostatically controlled heated substage which holds the components to be bonded; a micro-manipulator for positioning the work; a gas heating head; and a binocular microscope.

A new miniature ion gauge introduced recently by Associated Electrical Industries, of 33 Grosvenor Place, London, S.W.1, is considerably smaller than existing types and has the special advantage that direct pressure measurements can be made over the range 0.25 torr to 5 x 10^{-11} torr with a single measuring device. Another feature is the use of an oxide-coated iridium filament which will not burn out even if accidentally left on at atmospheric pressure.

A unique feature of the VH20 is the pure tungsten grid made from photo-etched 0.001 inch thick material. This exceptionally robust grid allows outgassing to red heat without danger of collapse.

The reduction in size achieved with the new ion gauge can be seen in this photo where the new type is compared with an earlier model.

The tiny devices seen here against a background of fingers holding them are the resonant elements of a new miniature 8mm Klystron developed by Elliot-Automation Ltd., 167 Great Portland Street, London, W.1. Known as the "Extended Interaction Klystron", it is said to be five times more efficient in producing microwave power than any other type of Klystron in current use.

The size of the new ion gauge type VH20 is 3 inches high and 1 inch in diameter compared with the 7in and 2in dimensions of the earlier type. The filament can be switched on at 760 torr as opposed to 10^{-3} previously, and the measuring range is now 0.25 to 5 x 10^{-11} torr against 10^{-3} to 10^{-10} torr previously.

In the field of radio astronomy, in which Britain in the 1950s established an early lead with the Jodrell Bank instrument, further progress had been made with a new one-mile long radio telescope installed for the Science Research Council at Mullard Radio Astronomy Observatory, near Cambridge.

The instrument uses a series of fixed and movable reflectors. The fixed trough type reflector has 34 parabolic frames with stainless steel wires. The mobile reflectors are 60ft diameter dish aerials, moved along a half-mile long track by a hydraulic motor which allows precise control at very low speeds.

Two of the 60ft diameter mobile reflectors of the Science Research Council's new radio telescope.

In the foreground is part of the radio telescope's fixed aerial, consisting of 34 parabolic frames.

New! STROBOTAC®

. . . an Advanced Electronic Instrument for Tachometry and Slow Motion Analysis of Fast Moving Devices.

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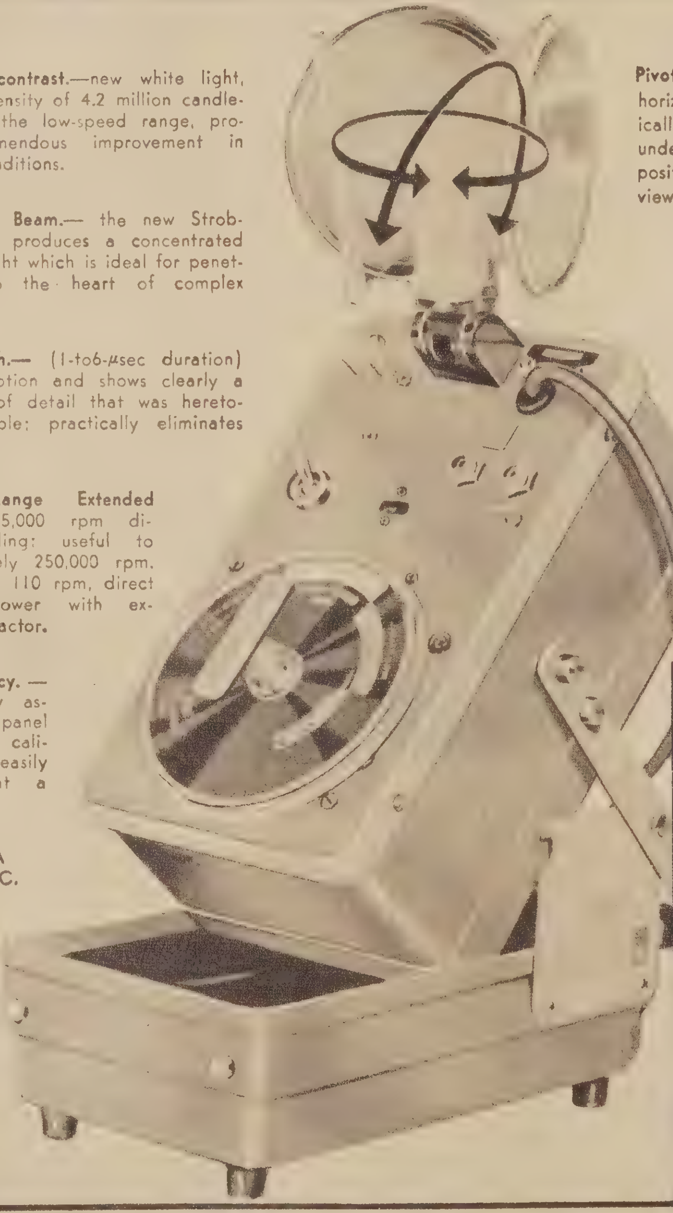
The STROBOTAC electronic stroboscope is a small portable flashing-light source used to measure the speed of fast-moving devices or to produce the optical effect of stopping or slowing down high-speed motion for observation. A few of this instrument's many uses are:

- Observation and speed measurement of gears, cams, linkages, shuttles, spindles, motor rotors, and any other elements having repetitive motion.
- Observation of vibrating members, fuel-nozzle spray patterns, and vibrations of components under test in wind tunnels.
- High-speed photography of repetitive or non-repetitive motion.



Improved contrast.—new white light, with an intensity of 4.2 million candlepower on the low-speed range, provides tremendous improvement in viewing conditions.

Long-Throw Beam.— the new Strobotron tube produces a concentrated beam of light which is ideal for penetrating into the heart of complex machinery.

Sharp Flash.— (1-to6-μsec duration) 'freezes' motion and shows clearly a a degree of detail that was heretofore invisible; practically eliminates blur.

Speed Range Extended Upward.—25,000 rpm direct reading; useful to approximately 250,000 rpm. Lower limit 110 rpm, direct reading; lower with external contactor.

1% Accuracy. — permanently assured by panel neon-bulb calibrator; easily checked at a glance.

Type 1531-A STROBOTAC.

Pivoting Lamp.— rotates 360 deg. in horizontal direction and 180 deg. vertically. Lamp can be aimed at object under investigation while instrument is positioned conveniently for a clear view of calibrated rmp scale.

Easier to read and to use,— one simplified dial and range switch controls rate of flash: only the scale to be used is illuminated, at a time. Direct reading from 110 to 25,000 rpm.

Lighter Weight.— just 7⅛ pounds; and only 2/3 size of previous model.

Unique Carrying Case — provides a convenient, adjustable stand, serves as rugged enclosure for instrument in storage or transit.

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SCIENTIFIC AND INDUSTRIAL NEWS

Computer course by radio

A second series of lectures on computers, entitled "Computers at Work—Part 2," will be broadcast over Radio University VL2UV transmitters in Sydney and Newcastle. The course of six one-hour lectures will be broadcast weekly, commencing in June. A seminar, which is complementary to the course, will be held in Sydney when the course has been completed. The course deals with the uses of computers, and will be of interest to scientists, engineers, managers and industry executives.

The fee for the course is $5 (£2/10/), which includes the printed notes essential for an understanding of the course. Enrolment closing date is May 20. Upon enrolment, students are sent details of a simple modification to domestic radio receivers to allow reception of Radio University. Further details are available from University of N.S.W., Division of Post-Graduate and Extension Studies, P.O. Box 1, Kensington, N.S.W.

New ceramic materials

New specialised ceramics have been developed by Steatite and Porcelain Products Ltd., of Stourport-on-Severn, Worcestershire, U.K. They include "HILOX" 961 and 972, both exceptionally hard and strong with valuable chemical, electrical and mechanical properties.

"HILOX 961" is said to be one of the strongest ceramic materials available in quantity. It resists abrasion and corrosion, and electrically is an excellent high frequency insulator with low electric loss. The makers say it should have many uses in mechanical engineering.

"HILOX 972" is a high-temperature material intended for electrical and electronic uses, including metal/ceramic assemblies for valves. As a high-frequency insulator at high temperatures its properties are exceptional and physical properties include strength, resistance to chemical attack and low neutron absorption.

Sealed winding transformer

New constructional principles devised by Bruce Peebles and Co. Ltd., of Edinburgh 5, U.K., have enabled them to put into service the world's first transformer with sealed windings designed for assembly on site. It is a 180MVA 275/132KV transmission auto-transformer now operating for the British Central Electricity Generating Board. The new principles overcome transport weight limitations for very large units or for particularly remote locations. The sealed-windings construction guarantees electrical integrity of the windings and insulation by ensuring that at no time are they exposed to the atmosphere after passing the full standard overvoltage and impulse tests. Use of a normal magnetic circuit with no additional joints or bridging pieces means that the inherent electrical and mechanical advantages of three-phase construction over the possible and more expensive alternative of a bank of three separate single-phase units are retained.

The windings are in a completely sealed centre-section which can be shipped separately, the other main components to be transported being the tank base carrying the bottom yoke and limbs of the core, and the top yoke laminations. Sealing of the centre section is achieved by closing off the steel shell which forms the tank wall at top and bottom with moulded polyester resin glass fibre. Vertical passages for the core limbs are provided by three moulded glass fibre cylinders, and the top and bottom glass fibre plates are sealed at their outer edges to flanges on the tank wall and also to the core limb passage cylinders. Adoption of these principles can save about half the transport weight as compared with a conventional unit. It is now possible to construct such a transformer for at least double the largest output obtainable with a conventional three-phase construction within the same transport weight limits. These new transformers would be technically superior as well as significantly cheaper than the single-phase types.

Gallium arsenide lamps

A new range of gallium arsenide infra-red lamps has been produced by the Dielectric and Magnetic Division of the Plessey Components Group. These subminiature lamps are p-n junction devices, emitting a cone of light of relatively narrow spectral width in the infra-red. Three models are available: a resin encapsulated emitter with no lens, a similar emitter fitted with a moulded resin lens ¼in diameter, and a unit mounted in a T037 header, forming a heat sink.

The new emitters, when used in conjunction with a silicon photovoltaic cell, can replace miniature tungsten filament lamps in a very wide range of equipment, and combine reduced physical size and power consumption with greatly improved reliability. Applications include punched tape readout, vending, weighing, and ticket issuing machines, and encoding devices. Very fast response time enables light output to be modulated at up to 100MC, enabling the emitters to be used in line of sight communication equipment. (Details available from Ducon Condenser Pty. Ltd., P.O. Box 2, Villawood, N.S.W.)

Nuclear plan to reclaim Australian desert

A representative of a United States development group has suggested the use of solar energy for the artificial formation of rain clouds, and nuclear energy to excavate a water reservoir, in order to reclaim 4.5 million acres of semi-desert land in Western Australia.

The proposals were made by Mr Cyril J. Means, Jnr.,

A 35-ton framework for a new radio telescope under construction at Chilbolton, Hampshire (S.W. England) is lowered into position under the watchful eye of a directing technician. The radio telescope will be used by the Radio and Space Research Station of Britain's Science Research Council in the investigations of problems associated with satellite radio communications, radio waves from the sun and planets, and the propagation of radio waves up to seven miles above the earth.

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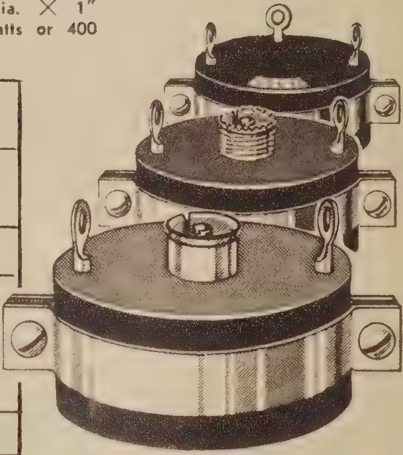
350A	Impedance ratio 1:1, 75 ohms unbalanced to 75 ohms balanced. 3 to 30 Mc/s. For use at centre of a dipole antenna with coaxial cable feed line or at base end with 75 ohm twin line. Coaxial connector is Belling & Lee L604/S and lug terminals.
351A	Impedance ratio 1:4. 75 ohms unbalanced to 300 ohms balanced. 3 to 30 Mc/s. For use at centre of a folded dipole antenna with coaxial feed line or at base end with 300 ohm twin line connector and terminals as 350A.
352A/BC	Details as 350A except freq. range 500 Kc/s to 5 Mc/s, or to 30 Mc/s, for receiving purposes only with increased attenuation.
353B	This is a type 350 with a coaxial socket SO 239 (Amphenol screw type).
354B	Type 351 with SO 239 coaxial socket.
355C	Impedance ratio 2·1:1 52 ohms unbalanced to 25 ohms unbalanced. 3 to 30 Mc/s. For use at the base of a mobile whip antenna, coupled to fixed or adjustable transmitter output impedance. Lug terminals.
356C	Impedance ratio 3·1:1. 78 ohms unbalanced to 25 ohms unbalanced. 3 to 30 Mc/s. Lug terminals. Use as 355C.



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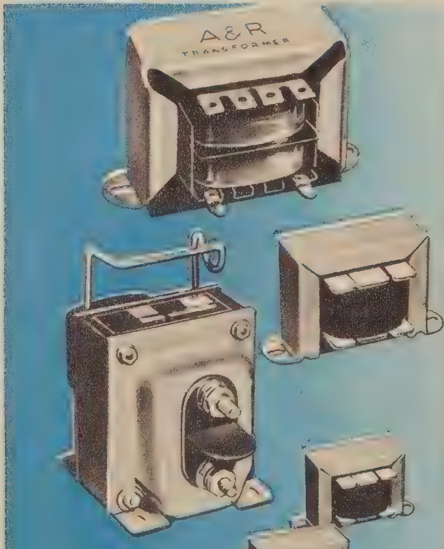

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- Driver, Output, and Modulation Transformers
- Power Transformers for Transistor DC-DC Converters
- Thyristor (SCR Trigger Transformer) for circuits similar to those described in "Miniwatt Digest" April, '64.

For full details on any of the above Transformers see your nearest A & R Stockist!

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projects co-ordinator of the Western Australian Corporation. He suggests the creation of (1) a 600 square mile bitumenised artificial catchment, and (2) a reservoir by nuclear explosion. The solar heat absorbed by the bitumenised catchment would heat the air which would rise swiftly, causing heavy cloud formation and rain, Mr Means said.

As an adjunct to the catchment, a reservoir would be made by atomic explosion using techniques already tested in the United States by the Plowshare project. The combination of catchment and dam, artificially installed, could provide the answer to the primary problem of the 10 inches to 12 inches annual rainfall required in the area, Mr Means said.

Metal treatment

New automatic electro-gas equipment for the treatment of metals has been designed by Stanelco Industrial Services, 4 Elstree Way, Boreham Wood, Herts, England. It can be used for soldering, brazing, hardening, annealing, shrink fitting and other processes. The equipment has been designed on the unit principle so that it can be used as a bench-mounted unit or integrated into an existing production line. Its claimed heat volume is in excess of 400,000 BTU's. Butane, propane or methane gases may be used.

In the factory of Elliott-Automation Ltd., at Primley, England, the stabiliser section of Britain's Skylark research rocket nears completion. A stabilised instrument payload built by this company was launched at Woomera in February and obtained X-ray photos of the sun, said to be better than any previously taken. Stabilisation was held constant within 30 seconds of arc. This is believed to be the only system in Europe that can align space payloads with planets.

Accurate watering of crops

A device known as an "integrating solarimeter" developed by a British company to indicate watering requirements of crops has shown that many crops are either over- or under-watered. The device accurately measures the amount of sunlight falling on any crop and thereby enables the amount of water it requires to be accurately calculated.

The integrating solarimeter consists of a panel of series-connected silicon photovoltaic diodes which convert light energy into electrical energy. Their output is used to produce a voltage proportional to the light input and also to produce the necessary power for operating the transistor circuitry and electromagnetic counter.

The voltage, which is proportional to the power received by the converter-diodes, is applied to a resistor-capacitor integrating circuit. The capacitor is also included in a monostable toggle circuit in such a way that the voltage developed across it triggers the toggle which, when operating, discharges the capacitor.

The amount of energy received by the solar converters may therefore be determined by counting the number of times the toggle has operated and discharged the capacitors. This function is carried out by an electro-magnetic counter. Calibration in the experimental model has been in the usual meteorological unit employed for this purpose, the milliwatt-hour per square centimetre.

Solid-state high speed switches

Transistorised fast switches which are virtually indestructible and likely to outlive any equipment in which they are installed have been introduced by The Marconi Company Ltd., of Chelmsford. Essex, U.K. They are completely encapsulated in hard Araldite, an extremely tough epoxy-resin, and are for use as direct plug-in replacements for mechanical telegraph relays used in all kinds of telegraph and telex equipment. They will operate almost indefinitely in most difficult conditions without maintenance. Approval has been given by the British Post Office for their use.

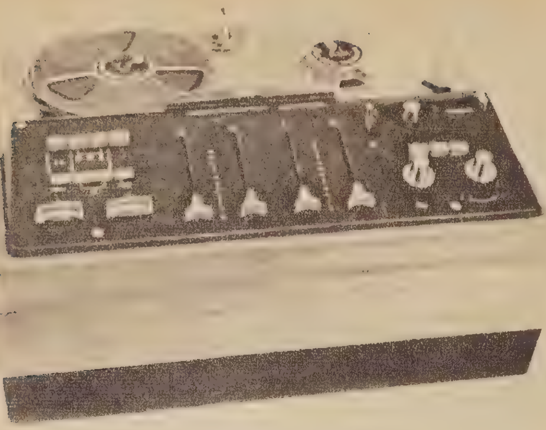
One batch of prototypes has been tested continuously during 24 hours a day for four months without fault. During the first six weeks of this period 440 million consecutive switching operations were carried out, after which the test was reduced to a slightly lower switching speed and has been in continuous operation ever since. It has even been shown that the unit can operate successfully in boiling water.

Multi-channel CRO recorder

A new low-cost oscillograph recorder for the mechanical and electrical engineering industries produced by Southern Instruments Ltd., of Camberley, Surrey, U.K., the MRE 141, can be particularly useful for manufacturers of turbine, rotary, and reciprocating engines of all types. It records simultaneously four channels of information, together with time, event and duration of event on 70mm or 120mm film or paper. It incorporates logic in all modes of operation, preventing initiation

Electronic components for a miniaturised computer weighing less than 200lb and occupying less than 4 cu. ft. of space, are tested here by an engineer of Sylvania Electric Products Inc., of 730 Third Ave., New York. The computer has some 3,500 integrated circuit packages, each containing the equivalent of 24 components, such as resistors, transistors, diodes and capacitors. The completed boards as illustrated are mounted in the MSP-24 (Miniaturised Sylvania Processor) which can operate simultaneously with up to eight peripheral devices such as magnetic tapes, card-reader punches, mass memories and communications channels.

BEOCORD 2000



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- ★ Professional standards for speed, wow and flutter.
- ★ True High Fidelity Stereo amplifier (solid state).
- ★ Three stereo inputs each with pre amplifier and slide potentiometer adjustment.
- ★ Separate record and playback amplifier and heads.

TECHNICAL DESCRIPTION:

Dimensions: Suitcase Model: 17.7in long, 14in deep, 10in high, including lid and speakers, 7.5in high less speakers. (Table model 8.2in high.)

Weight: 35lb. Table model 46lb. Suitcase model.

Supply Voltage: 240 volts 50 cycles AC.

Playing Time: Depends on speed and length of tape, e.g., 1800ft tape (7in reel with LP tape) ½-track version at 1 7/8" is 3 hrs. Fast forward and rewind: approx. 150 sec. in either direction for 1800ft tap (LP).

Power consumption: Motor: 27 watts. Amplifier (no signal) 8 watts or (full volume) 20 watts.

Reel diameter: 7in or less.

Heads:
Recording head: 10 /u gap: 2 x 15 mH.
Playback head: 3 /u gap: 2 x 30 mH
Ferrite erase head: 2 x 2 mH: 2 x 100/u.
The 2-track model has two erase heads.

Tape speeds:
7½in, 3¾in, and 1 7/8in/sec. Speed can be changed during operation.

Tape-length counter: Push-button for reset.

Automatic stop: At end of reel or if tape breaks. Operates on all tapes.

Pause stop: Lever can be locked.

Loop Compensator:
The take-up reel is equipped with a loop compensator to prevent jerks when starting. Provides smooth starting and stopping at any speed.

Main switch:
Integral with speed-change switch. Idler is disengaged when the switch is in the off position.

Amplifier Switch: The tape-recorder amplifier may be operated separately. A switch is provided for switching the amplifier on and off without startin gthe motor.

Recording-level indicator:
2 moving coil VU meters, have built-in pilot lights. White light for playback, red light for recording.

Mixer:
Three input channels with separate potentiometers for mixing the following: Microphone Input. The standard version is for balanced input for monaural or stereo quality microphone, such as the B and O Type BM5 or MD8 mono stereo microphone. Input sensitivity 150 /uV.

Gramophone Input: Input for low-impedance stereo pickups, such as B and O types SP1 and SP2. Input sensitivity: 2mV/1000 cs.
Compensated for RIAA curve.

Radio Input. Input sensitivity: 1) without pre amplifier. 45 mV/10 k ohms 2) with pre amplifier 5mV/45 k ohm. For connection to a conventional radio set. (All input sockets DIN.)

Monitoring Feature:
For listening in on tape programs both before and after recording. Monitoring of the recorder program is delayed by fraction of a second.

Output control:
Separate potentiometer for adjustment of playback volume and monitoring volume. Loudness compensated volume control.

Speaker switches: 3 push buttons 1, External speaker 2, built-in speaker 3. Built-in speaker attenuated (to permit microphone recording near the tape recorder).

Echo button:
While recording, the recorded signal can be mixed into the recording by depressing the echo button. This provides an echo corresponding to the time lag between the recording and playback heads. Separate control for Echo adjustment.

Multiplay.
For recording monaural, the echo button may be used for transferring a recording from one track to another. This feature permits one-man part-singing.

Synchronous Monitoring:
To secure synchronisation when recording pilot tones for an automatic slide projector, one half of the recording head may be monitored by depressing the synchronous monitoring button.

Line Input and Output:
Sockets in accordance with international standards. Line output voltage: 800 mV. Can be used for headphone monitoring

Connecting a Telephone pickup: The microphone input may be employed for connecting a telephone pickup.

Amplifier:
The amplifier is fully tranistorised. It comprises:

(1) a 2-channel microphone pre amplifier. 2 — AC 126: 2 — AC 107.

(2) a 2-channel gramophone pre amplifier. 2 — AC 107.

(3) a 2-channel radio pre amplifier: 2 —AC 126: 2 — AC 107.

The pre amplifiers are plug-in units. If the outputs of three microphones are to be mixed microphone pre amplifiers may be substituted for the gramophone pre amplifier and the radio pre amplifier.

(4) Recording amplifier. A separate 2-channel recording amplifier is provided. Transistors 4 — AC 126: 2AC107.

(5) Playback amplifier. A separate 2-channel playback pre amplifier is provided. Transistors 6 — AC 126.

(6) Output amplifier. 2 8-watt transistor power amplifiers are provided. Transformerless output. Transistors 1 x AC 107, 1 x AC 128, 1 x AC 127, 1 x AC 132, 2 x AD 139.

(7) Power supply. Transistors 2 — OC 75, AC 128 AD 140. Diodes 15/5170B, 2 x BY213.

(8) Erase oscillator. Transistors 2 x AC 128.

Controls operate only in the playback amplifier. Separate knobs for bass, treble, balance.

Amplifier data and sensitivities. Output power 2 x 8 watts.
Harmonic Distortion: 1 per cent by 5 watt output.

Frequency Response:
7½in½sec 30 — 20,000 c/s (±2 dB 40—16,000 c/s) 3¾in/sec. 30 — 16,000 c/s (±2 dB 40 — 12,000 c/s), 1 7/8in/sec. 50 — 8,000 c/s (± dB 50 — 6,000 c/s).

Sensitivity:
Microphone input: 150 /uV. Gramophone input 2 m/V 1000 c/s. Radio input: 5mV. Line output: 45mV.
Line Output Voltage: 800 mV. Speaker impedance: 3.5 ohms — 10 ohms. Wow values listed are for reproduction equalised according to normal listening weighting wow frequencies 4 c/s attenuated 3 db/octave.

	Peak to Peak Value.	RMS Value.
7½in/sec.	0.2%	0.075%
3¾in/sec.	0.3%	0.11%
1 7/8in/sec.	0.5%	0.18%

Channel separation: better than 45 db.

Signal/Noise Ratio:
½-track: 55 db at a recording level producing 3 per cent harmonic distortion.
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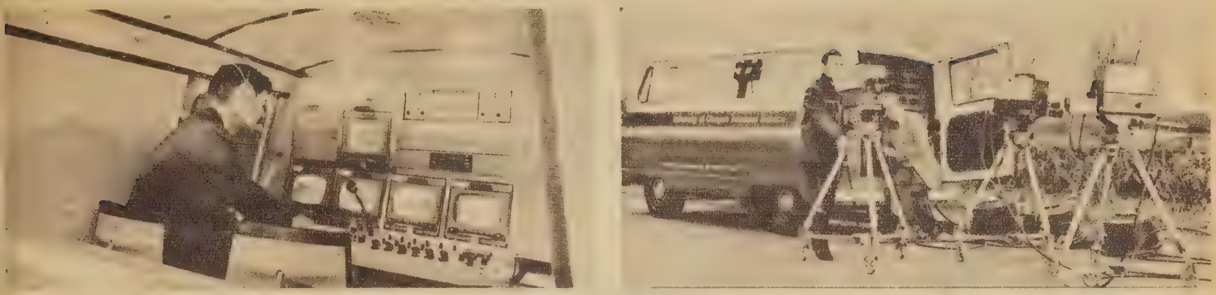

The University of Glasgow, Scotland has an extensive closed-circuit television system in operation, and has now added a completely equipped four-camera outside broadcast unit. It is the first to be designed for an educational establishment, and has been supplied by Marconi. It will be used to record lectures on tape for subsequent use by the university and other establishments, as well as for relays to subsidiary lecture rooms.

of the event or accidental exposure. Single-shot or repetitive records can be taken and calibration signals may be recorded before, during or after the event.

Triggering is performed by input voltage level, preset time delay, or counting cycles of an input signal. Programs can be arranged for monitoring at discreet intervals in times ranging from one millisecond to two days. Eight functions can be recorded simultaneously in X-Y presentation, with additional time and event markers, and recording cameras are included for single shot, continuous feed and drum operation. An accuracy of 1 per cent can be obtained and it is possible to record from DC up to 0.25MC. There is also room to include combinations of 2MC FM and DC pre-amplifiers and other ancillary panels. MRE 141 operates from standard AC mains.

Variable speed drive

The eddy-current principle is used as the basis for couplings developed by Mawdsley's Ltd. of Dursley, Gloucestershire, U.K., to produce a variable-speed drive from a constant-speed input, such as from a standard AC induction motor. These liquid-cooled couplings are available in sizes to give torques corresponding to 30-375BHP at 1450 RPM input and are equally suitable for other input speeds. Speed is controlled by a feed-back servo loop and once set remains virtually unchanged whatever the load applied to the output shaft.

The input shaft torque is transmitted by magnetic flux to the output, there being no mechanical connection between the two. The electrical energy dissipated due to the difference in speeds between the input and output shafts is removed by cooling water. Stalled conditions on full load torque can be accommodated continuously.

A wall-mounted controller continuously monitors the output speed, drive torque or whatever other parameter it is required to control and compares this with a set value. The DC excitation feed from the controller is thus varied to maintain the required performance irrespective of load. The set value of speed, etc., together with controls for starting and stopping can be adjusted from an operator's control station located at any convenient point. The cooling water is automatically controlled to prevent excess water running to waste. Excess temperature and subnormal pressure alarms are incorporated. Leakage of water into the bearing spaces is prevented by rotating baffles and interlocks.

Integrated circuits from IBM

Information on new, high-speed integrated circuits which will speed operation of computers comes from IBM in the U.S.A. Experimental monolithic circuits have been developed which function at sub-nanosecond — or picosecond — speeds. They can complete a logic operation in 700 picoseconds. By comparison, the fastest logic circuit in today's computers function in times in excess of one nanosecond. The fastest in IBM computers currently operating need about 1.5 nanoseconds.

Details of the sub-nanosecond circuits were presented at the opening session of the recent 1966 International Solid State Circuits Conference by Leonard Weiss, of the IBM Systems Development Division, East Fishkill, N.Y.

Direct current power transmission

The first production model of a four-anode converter valve for DC transmission schemes is completing tests by The English Electric Company Limited, Stafford, U.K. The valve is rated at 1200A and 133KV in bridge connection.

English Electric have carried out prolonged research into transmission by direct current, which in certain cases shows considerable savings over equivalent AC methods. At present they are the only British manufacturers to have on hand contracts for the engineering and supply of DC converter stations. The converter stations for the 200MW DC link between Sardinia and the Italian mainland have valves purchased from ASEA (Allmanna Svenska Elektriska Actiebolaget) but for future contracts valves supplied will be of English Electric manufacture.

To ensure that valves are not merely adequate, but of optimum design, English Electric is undertaking a comprehensive valve research and development program of its own. To relate physical studies to practical engineering, single-anode oil-cooled research valves have been constructed to English Electric design and two such valves have been supplied to the Marchwood Laboratories of the British Central Electricity Generating Board. The aim of the research is to increase fundamental knowledge of valve physics and to improve existing designs. Valves of this type, but rated at up to 200KV DC and higher, likely to be used in future installations, would reduce capital costs of converter stations by up to 10 per cent.

Seen here at the Lockheed Propulsion Company's testing ground in California before and during a test firing is the "156-6" solid propellant rocket motor. Designed as a flight prototype second stage, the motor developed one million pounds of thrust and burned for 65 seconds. A three-million pounds potential first stage was successfully tested one month before this test.

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Plated resin coatings

A German firm has patented a way of applying synthetic resin coatings to metals and other conductive surfaces by electrical deposition which gives a smooth, hard, glossy finish. The company, Glasurit-Werke, M. Winkelmann A. G., Hamburg-Wandsbek, Am Neumarkt 30, claims that by this method the range of layer thicknesses can be varied over very wide limits and a coating thickness of over 100 microns can be applied in a single operation.

Multi-layered coating

A coating designed to protect metals from heat and corrosion damage is based on a thermosetting plastic material applied layer by layer in at least six steps to provide an impervious skin. Called Vetrodur and offered by Verzinkerij Mook N.V., of Mook, Holland, the coating is not baked until the final layers has been applied. Then the application of a high temperature produces a hard, shining and non-porous surface.

Flexible electric heating

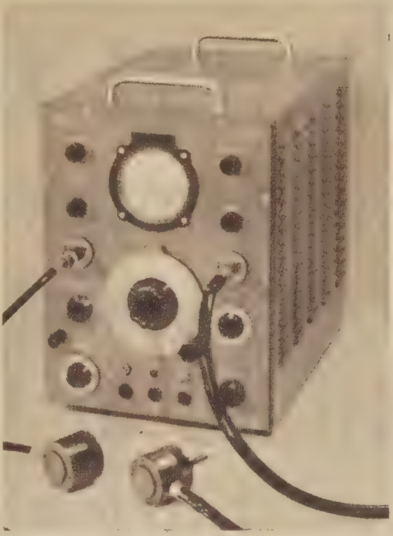
Flexible electric heating systems capable of being wound or traced on pipelines or vessels and marketed under the name Thermotrace are now being supplied by Electrothermal Engineering, of 270, Neville Road, London, E.7. Insulations available include PVC glass fibre and quartz fabric. The system can be used indoors, outdoors, in subzero conditions and for maintaining the flow of molten metal.

Cloth conducts electricity

A group of electrically conductive textile fabrics with controlled resistivities over a wide range has been developed in U.S.A. by Union Carbide Corporation. Known as Ucar electrically conductive cloth, the new composite material can be used as a heating element in configurations from narrow ribbons to large blankets. One of the first commercial applications is in seat heaters for 1966 cars.

The electrically conductive fabrics are made in a variety of patterns, as shown.

The new cloth is made by weaving Union Carbide's conductive carbon yarn with insulating glass yarn. Electrical conductivity is a natural attribute of carbon yarn — no coatings are used — and the yarn can be compared to high resistance wire. The volume resistivity of National grade VBY carbon yarn at a room temperature is approximately 0.006 ohm-centimetres, some 60 times that of Nichrome wire and about 3500 times that of copper. Carbon yarn is clean, has a slight negative temperature coefficient of resistance, and is about 2/3 as strong as glass yarn of the same weight. The high strength of the carbon yarn, combined with relatively high resistance, means that carbon yarn is many times stronger than wire of the same resistance per unit length. Another suggested use is as a permanent high-resistance path to bleed off static electricity.



Illustrated is a "Dynamic Auscultator" developed in France by Laborataire Electro-Acoustique, 5 Rue Jules Parent, Rueil Malmaison, S. and O., for non-destructive testing of mineral and ceramic materials. The dynamic auscultation method consists of measuring the speed of sound propagation in a given material by comparing the time interval for a shock wave to pass through a known distance in two different places. Sound absorption characteristics may also be measured simultaneously.

Nitrogen filled springs

An addition to the group of steel helical, steel leaf and rubber and air springs already familiar to engineers is announced by Stabilus Industrie and Handel G.m.b.H., of 47-53 Herberichstrasse, Koblenz - Neuendorf, Germany. This time it is a nitrogen - filled spring, which depends for its action on the compressibility of that gas.

The spring consists of a cylinder filled with nitrogen in which a piston is free to move. The maker claims that the overall length of the spring needs to be only a fraction of an equivalent air spring and that very high loads can be carried. The company says it is suitable for mass production.

Reduces pipe end diameters

A hydraulically operated machine for reducing the end diameters of small lengths of metal tube is being produced by a Dutch company. It has been designed to reduce the ends of tubes which have to be inserted in each other and the machine will handle between 1,000 and 1,200 tubes per hour, depending on the length to be reduced.

Tubes are automatically fed from a magazine into the machine and when reduced are ejected. Maximum length of tube which can be handled is 27½ inches and maximum diameter 0.98 inch. Lengths of reduction can be up to 2.36 inches. The machine is being manufactured by W. Veenstra and Co. N.V., Sarphatikade 7, Amsterdam. ▣

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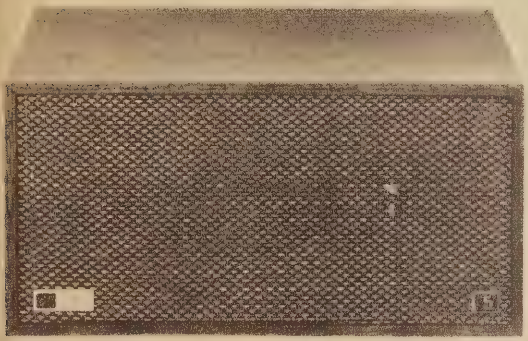

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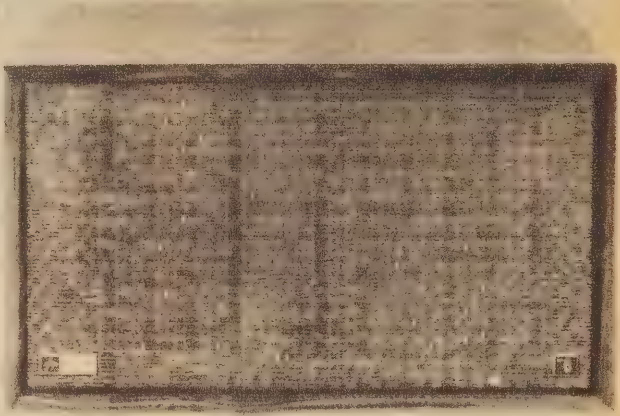

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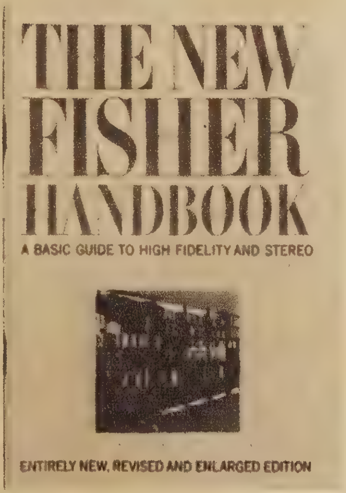

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By Jamieson Rowe

The oscilloscope design to be described in this article has been developed as part of our current series of compact measuring instrument designs. As with the other designs of the series, it aims at striking an attractive engineering compromise between simplified construction using easily obtained components, and the compactness and high performance attainable using modern components and circuitry. (Other designs in this series include the Transistor Audio Oscillator of September, 1965, and the Protected Transistor Supply of last month.)

Although fairly unique in conception, the new design may be regarded basically as a simplified version of the author's "Fully Calibrated Oscilloscope" described in the June, July and August, 1963, issues. The experience gained both from personal use of the 1963 instrument and from the reports of various constructors has played no small part in determining the new design.

Right at the outset it should be stressed that the new design is not intended to replace the 1963 design or render the latter obsolete. Rather it aims at providing a somewhat less costly and simplified instrument, capable of performing many, but by no means all, of the tasks performed by the larger instrument.

In some ways the development of the design has been an engineering exercise to determine how many of the worthwhile functions and facilities of the 1963 instrument could be retained while stripping away the rarely used but often costly "frills" and simplifying the construction and operation. Inevitably, this has involved one or two compromises; however, it is felt that the new design will probably suit very well the needs of the advanced experimenter and service technician.

Some of the features of the 1963 instrument which have **not** been incorporated into the new design are graticule illumination; DC coupling in the vertical amplifier; horizontal expansion; external synchronisation; and the two slowest timebase ranges. These features have been omitted mainly because their limited usefulness was considered to be out of proportion to the degree of circuit complexity or cost involved.

On the other hand, there were a number of features of the 1963 design which were considered too valuable to be omitted, although in some cases simpler circuitry has now been adopted for their provision. These include a calibrated vertical attenuator and timebase, to give the instrument worthwhile measuring capabilities; automatic zero-level and adjustable-level synchronisation using the now-established Schmitt trigger circuit; and the provision of a voltage-time calibrating signal at a terminal on the front panel.

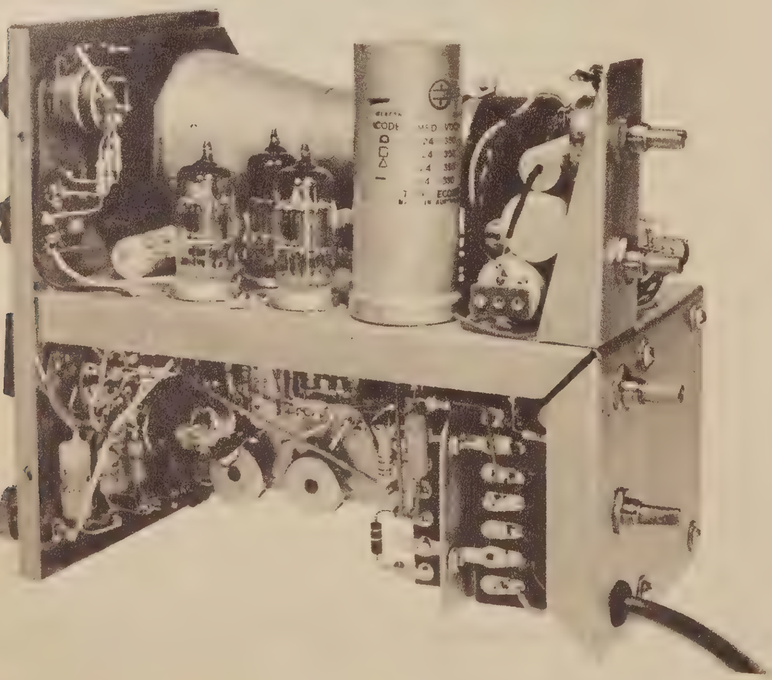
In addition to the features retained from the earlier design there are a number of new features, many of which have been incorporated as a result of personal experience and the experience of other constructors. These include an automatic brightness control circuit; increased EHT for improved trace clarity; provision for disconnection as well as stoppage of the timebase when it is not required; a front-panel pilot lamp; and a tilting foot arrangement for more convenient bench use.

And, of course, considerable effort has been directed to making the new design not only simpler and easier to assemble and service, but also easier to use. Although the instrument is less than one-half the volume of the 1963 design (itself quite modest), we feel we have evolved a layout and construction which will, in fact, involve fewer problems. Not only this, but with fewer preset controls and simpler circuitry the instrument should be somewhat easier to set up and calibrate.

In short, we're rather proud of this little instrument, and hope that it proves as popular a project among readers as its qualities would seem to merit.

The circuit diagram of the new design shows that it employs only five valves apart from the cathode-ray tube; two valves are used in the vertical amplifier and the remaining three in the horizontal system. The power supply uses four silicon diodes, and a neon lamp gives double duty as both pilot light and calibrating signal clipper.

The vertical amplifier employs two 6GH8 triode-pentode valves, the triodes being used as input cathode follower and voltage amplifier ahead of the output stage which uses the pentodes in a long-tailed pair configuration. Direct coupling from the output valve plates permits the use of amplified trace positioning to ensure that the visible section of a trace corresponds to linear amplifier operation; in contrast, AC coupling for the earlier stages simplifies power supply requirements and allows the use of economical unbalanced circuitry.



Compact 3in oscilloscope featuring calibrated vertical amplifier and timebase.

VERTICAL AMPLIFIER: AC coupled, with a response between —3dB points of 10cps—1.3MC; useful response to 2MC. Nominal sensitivity of 100mV/cM. Switched attenuator reduces sensitivity in 1:2:5 ratio steps to minimum of 20V/cM; further reduction by external divider probes. Input impedance approx. 1M shunted by 15pF.

HORIZONTAL AMPLIFIER: AC coupled, with a response between —3dB points to 10cps—200KC. Sensitivity approximately 1V/cM; input impedance 1M shunted by 15pF.

TIMEBASE: Switched speeds from 50mS/cM to 10uS/cM in 1:2:5 ratio steps; continuous control permits interpolation and reduction of slowest speed to approximately 75mS/cM. Timebase may be disconnected from horizontal amplifier and also turned off if not required.

SYNCHRONISATION: For signals below 100KC, automatic zero-level or adjustable-level synchronisation on either positive — or negative — going slope via Schmitt trigger circuit. For signals above 100KC direct zero-level synchronisation, polarity adjustable.

DISPLAY: Cathode-ray tube operated from approximately 600V for sharp trace. Automatic brightness circuit ensures trace visibility at all speeds. Focus and astigmatism controls and trace shift controls fitted at rear of instrument. Optional intensity modulation. Mains-derived 1V p-p 20mS calibrating signal provided on front panel.

The vertical attenuator is very similar to that used in the 1963 instrument; it provides eight fixed sensitivity ranges, in accurate 1:2:5 ratio steps from 100mV/cM to 20V/cM. Although the input impedance of the attenuator is not constant for all ranges the circuit is very economical in terms of components and the impedance variation involved will rarely cause embarrassment.

The input impedance never falls below 1M shunted by about 15pF, which is comparable with the majority of instruments. Where this impedance causes undue circuit loading a divider probe or cathode-follower probe may be used, as will be described later.

The full gain of the vertical amplifier provides a maximum initial input sensitivity of approximately 60mV/cM to provide a suitable margin for valve and component aging. The vertical sensitivity is adjusted by the 10K tab pot in the cathode of the first stage, which provides a frequency-independent "calibrate" adjustment.

The vertical attenuator is fully compensated for the frequency range of the amplifier. When properly adjusted the attenuator and amplifier have a smooth response of 10cps—1.3MC between -3dB points, and a useful response to above 2MC. This performance should be adequate for most experimental and servicing applications.

The horizontal amplifier uses the pentode sections of two 6BL8 (ECF80) triode-pentodes in a long-tailed pair configuration similar to that in the vertical amplifier. DC coupling is again used to permit amplified trace positioning. An adjustable feedback circuit in the common cathode circuit is used to vary the gain of the stage, the 5K tab pot between the cathodes becoming the "time calibrate" adjustment.

The input sensitivity of the horizontal amplifier stage is approximately 1V/cM, which should be quite adequate for Lissajous figures and other applications involving an external horizontal signal. The frequency response of the amplifier is approximately 10cps—200KC between -3dB points, with a useful response to about 500KC. Input impedance is approximately 1M shunted by 15pF.

The timebase is a free-running multivibrator circuit using the triode sections of the 6BL8s. Its operating speed is determined by the R-C time constant in the cathode circuit of V6a. Sweep ranges are set by switching various values of C while 1:2:5 multiplication of the ranges is provided by switched values of R. An additional 1M pot provides continuous sweep adjustment for interpolation and to extend the slowest speed. The overall sweep range is approximately 75mS/cM—1uS/cM (approx. 3cps—200KC).

The linearity of this timebase circuit is not quite as good as the Miller transitron type used in the 1963 instrument. However, the new circuit is far simpler and easier to adjust, and is considered quite adequate for most applications.

When not required the timebase is disabled by opening the cathode circuit of V6a. The timebase output can also be disconnected from the horizontal amplifier input by removal of the interterminal link. For special purposes the timebase signal may be used to drive external circuitry; external timing components may also be used with the timebase by connecting them between the output terminal and earth.

A 12AT7 (ECC81) valve is used in the synchronisation circuit. For signals below 100KC this valve is operated as a Schmitt trigger to produce a square-wave equivalent of the signal applied to the vertical plates, with a relative polarity determined by the "synch. pol" switch. The trigger may be operated in either the "Auto" mode, in which it triggers on zero crossings of the vertical signal, or in adjustable mode where the triggering point is determined by the setting of the 100K pot. In the automatic mode the sensitivity of the trigger may be adjusted by the 50K pot so that it is insensitive to HT ripple, etc.

For signals above 100KC, operation of the valve as a Schmitt trigger becomes erratic. However, by adjusting the 100K pot so that the valve does not trigger it operates as a HF amplifier and provides quite reliable direct synchronisation.

In both the LF and HF modes of operation the output of the 12AT7 is fed to the timebase via a 22pF capacitor and 100K resistor, these components providing a measure of differentiation to ensure steady and distortionless synchronisation.

The display tube circuit of the new instrument is fairly straightforward, and warrants little discussion. The power supply is a voltage-doubler type using two AS3 (BY100) silicon diodes, and delivers some -400V to the grid of the tube. As the deflection plates are at approximately 220V positive with respect to chassis, this makes the total tube voltage in excess of 600V, and gives a clear sharp trace.

The tube itself is the DG7-32/01, as used in our previous three-inch instruments. As far as we are aware, this tube is the least costly of the new tubes available for oscilloscope use; it is also

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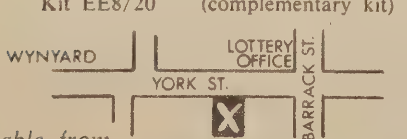

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the most readily obtainable. Substitute tubes may be available from disposals sources but rarely will these prove satisfactory, either having lost trace brightness and/or clarity in the years since they were made, or being embarrassingly low in deflection sensitivity.

It should be noted that because of the compact nature of the new instrument an effective tube shield is virtually a necessity despite the use of a low radiation power transformer. We would recommend the use of a mu-metal shield for optimum shielding; such shields may be obtained from the tube manufacturers. They are not cheap, but are most effective in securing a hum-free trace.

Automatic brightness for the tube is achieved by connecting the tube grid direct to the negative supply and fitting a self-bias resistor (270K) in series with the cathode. As bias is therefore made a function of screen current, the trace tends to stabilise at a level of brightness which is virtually independent of sweep speed or pattern size.

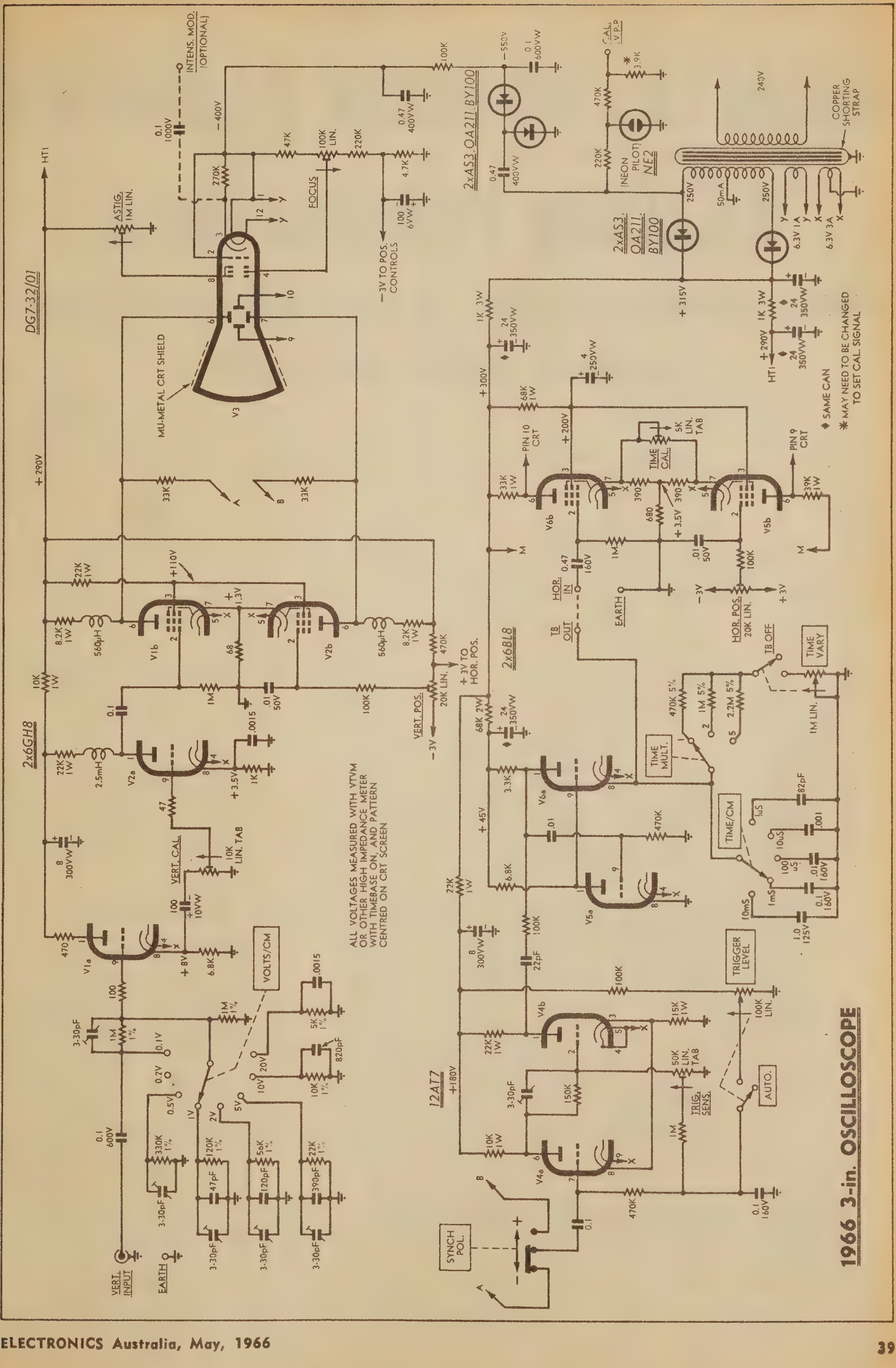
A detail view of the power supply wiring of the new CRO, showing the two tagstrips and their support plate.

It should be noted with respect to this circuit that individual tubes may vary in their control characteristics. Thus with some tubes it may prove necessary to alter the value of cathode resistor from that shown in order to arrive at a convenient brightness level. In general, higher resistor values will give a less bright trace and vice-versa.

As the brightness level remains relatively constant with this circuit, the focus and astigmatism controls rarely need to be adjusted once set. They have therefore been relegated to the rear of the new instrument, along with the two trace positioning controls. This reduces the number of front-panel controls to a bare minimum and makes for simplified and convenient operation.

Intensity modulation may be applied to the cathode-ray tube via a capacitor to the cathode (negative modulation). The capacitor used for this purpose should be a low-leakage high-quality type rated at 1000VDC working. It may be noted that retrace blanking is not fitted to the instrument, the retrace being sufficiently rapid at most speeds to cause

The complete circuit of the new instrument is shown opposite. Only five valves are used apart from the CRT.



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40349 $h_{FE} = 25\text{-}100$ @ $I_C = 150$ mA V_{CEV} (Max) = 140V	2N3441 $h_{FE} = 20\text{-}80$ @ $I_C = 0.5$A V_{CEV} (Max) = 160V	2N3442 $h_{FE} = 20\text{-}70$ @ $I_C = 3$A V_{CEV} (Max) = 160V	2N3773 $h_{FE} = 15\text{-}60$ @ $I_C = 8$A V_{CEO} (sus) (Min) = 140V

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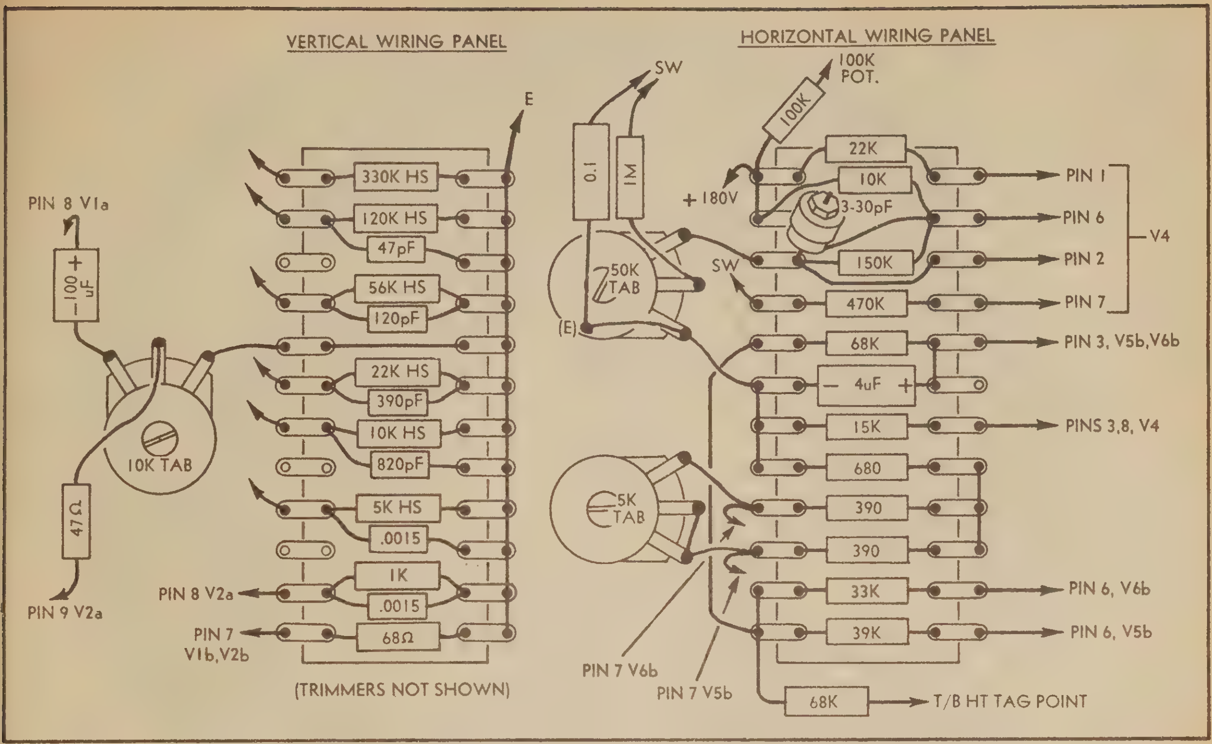
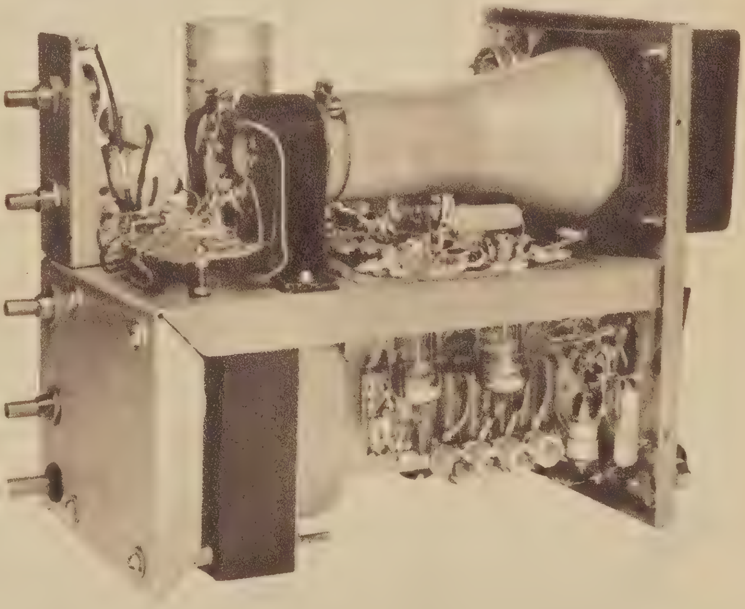
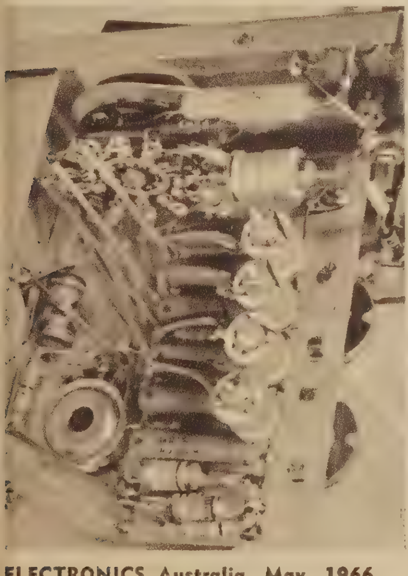


Above, two diagrams showing the components and connections associated with the two 12-lug miniature resistor panels. Below is a view of the left-hand side of the instrument, while at lower left is a detail shot of the vertical attenuator components.





negligible embarrassment. With the simple timebase employed blanking is not easily provided.

The main power supply of the instrument is quite simple and employs a further two AS3 silicon diodes in a full-wave rectifier circuit. Resistance-capacitance filtering and decoupling are used throughout for economy. The power transformer is a unit first employed in our 3-inch TV CRO of August-September, 1960, featuring a shorted-turn copper strap for low external radiation.

Four of the 24uF/350VW electrolytic capacitors used for HT filtering and decoupling are combined in a chassis-mounting can for space economy. The quadruple-24uF unit is the same as that used for our Stereo Tape Recorder of February-June, 1962.

The 1V p-p 20mS front-panel calibrating signal for the new instrument is derived from the secondary of the power transformer via a clipper circuit, using an NE2 neon bulb which also serves as the pilot lamp. As neon lamps vary slightly in their ignition voltage the resistor connected between the calibration terminal and chassis may need to be altered from the value shown to adjust the signal to exactly 1V peak-to-peak.

The mechanical side of the new design is as straightforward as the circuitry. The front panel is identical in size with that of the small case used for the other compact instruments—only 7½in x 5in. The case itself is only a little more than twice the depth: 8½in. This makes the instrument the most compact yet to be described.

As may be seen from the photographs the case is provided with a tilting foot which permits the instrument to be tilted up for convenient bench operation. The foot is bent up from 16G aluminium or 18G steel sheet and folds flat against the bottom of the case when not in use.

The chassis of the instrument is basically an "L"-shaped bracket fastened to the front panel by the vertical attenuator, synch polarity and timebase switches. It has a ¾in lip along both sides and rear

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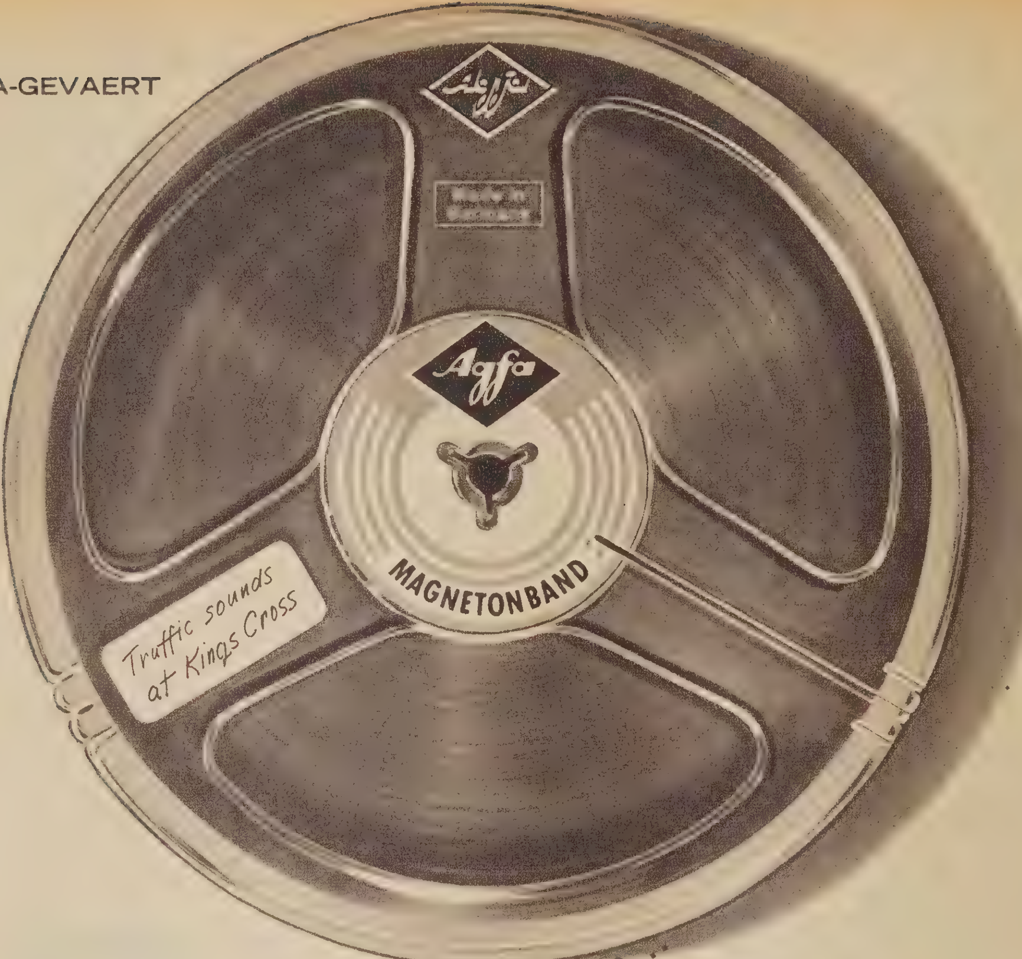

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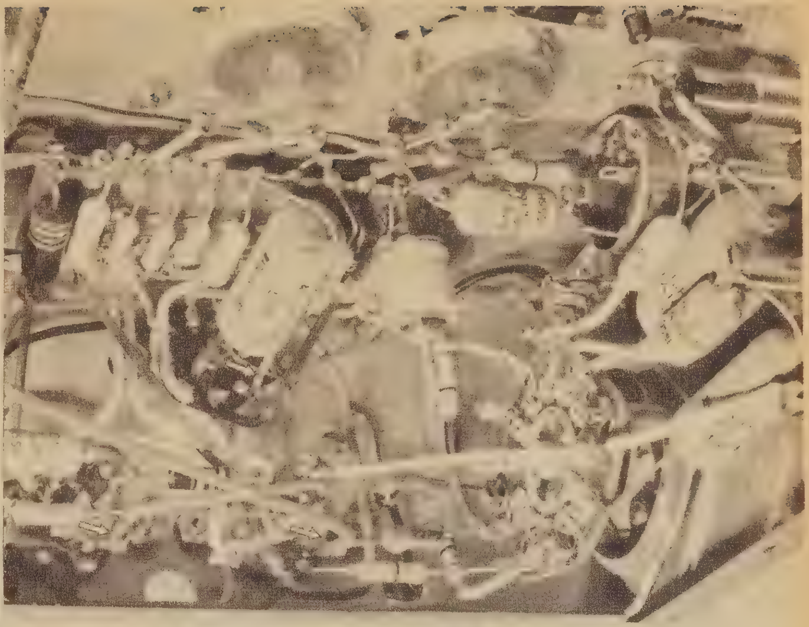
The tube base and socket are clamped to the top of the chassis by simple strip brackets, while the screen end sits in an octagonal guide mounted on the rear of the front panel. A small viewing hood protects the tube screen from incident light, aided by a tinted graticule plate.


A detail shot of the horizontal amplifier, timebase and synch circuitry wiring. The arrows indicate valve socket orientation.

The vertical attenuator wiring is mounted on the switch itself and on a 12-lug section of miniature resistor panel adjacent to it. Also mounted on the panel are cathode components of V2a and the 68 ohm cathode resistor of the long-tailed pair V1b-V2b. Adjacent to the resistor panel on the vertical shield plate is the 10K tab pot for vertical calibration, adjusted via a screwdriver through a small hole in the side of the case.

Because of the limited space in the case the vertical amplifier valves are mounted upside down. Using the wiring layout shown this is quite in order since the attenuator wiring is compact and leaves adequate space beneath for the valves. Similarly there is ample space between the top of the chassis and the C-R tube shield in which to fit the amplifier wiring.

The valves of the synchronising, timebase and horizontal circuitry are mounted in normal fashion above the chassis, with the majority of the wiring beneath. Here again a 12-lug section of miniature resistor panel mounted on the vertical shield plate supports many of the minor components. The 50K triggering sensitivity and 5K time calibrating tab pots are mounted on the shield plate adjacent to the resistor panel, again to allow screwdriver adjustment via small holes in the side of the case.

The power supply wiring is supported by two 7-lug tagstrips attached to a small aluminium or steel plate bolted to the power transformer; the latter is in turn bolted to the rear of the chassis. The tube and EHT supply wiring is supported by a miniature tagstrip and resistor panel above the chassis at the rear.

Construction of the oscilloscope should be a fairly simple and straightforward matter using the circuit, photographs and wiring diagrams as a guide. However, it will be found that the following order of assembly and wiring is most convenient.

First mount the focus-astigmatism control bracket to the chassis and fit all four rear control pots. Then mount the power transformer inside the chassis, using the bolts and spacers supplied with the transformer and including the tagstrip support plate under the nuts on the power supply side. Then attach the chassis to the front panel using the two main switches and the slider switch.

For correct orientation of the two main switches note that a line drawn through the timebase switch assembly screws should be vertical while a similar line drawn through the vertical attenuator switch should intersect the axis of the

COMPONENTS YOU'LL NEED

1 *Case, front panel and chassis, 7½in x 5in x 8½ in.*
1 *Power transformer, 250-0-250V secondary at 50mA, 6.3V at 1A, 6.3V at 3A CT, low radiation type, spacer mounting.*
1 *Set brackets, shield plate, tube hood, graticule, etc.*
1 *Rotary switch, 1-section 1 pole 8-position.*
1 *Rotary switch, 1-section 2 pole 5-position.*
1 *Slider switch, 1 pole 2-way.*

VALVES AND DIODES

2 *6GH8.* 2 *6BL8/ECF80.*
1 *12AT7/ECC81.*
1 *DG7-32/01 CRT with mu-metal shield.*
4 *AS3, BY100 or similar silicon diodes.*
1 *NE-2 neon bulb, in pilot bezel.*

CAPACITORS

400VW unless specified: *6 x 3-30pF air trimmers; 22pF; 47pF; 82pF; 120pF; 390pF; 820pF; .001uF; 2 x .0015uF; 2 x .01uF 50V; .01uF 160V; .01uF; 2 x 0.1uF 160V; 2 x 0.1uF; 2 x 0.1uF 600V; 0.47uF 160V; 2 x 0.47uF; 1uF 125V.*

Electrolytics: *4uF 250VW; 2 x 8uF 300VW; (4 x 24uF 350VW) chassis type; 100uF 6VW; 100uF 10VW.*

RESISTORS

5 per cent type: *47 ohm ½ watt; 68ohm ½ watt, 100ohm ½ watt, 2 x 390ohm ½ watt; 470ohm ½ watt; 680ohm ½ watt; 1K ½ watt; 2 x 1K 3W; 3.3K ½ watt; 3.9K ½ watt; 4.7K ½ watt; 2 x 6.8K ½ watt, 2 x 8.2K 1W; 2 x 10K 1W; 15K 1W; 4 x 22K 1W; 2 x 33K ½ watt; 33K 1W; 39K 1W; 47K ½ watt; 68K 1W; 68K 2W; 5 x 100K ½ watt; 150K ½ watt; 2 x 220K ½ watt; 270 K ½ watt; 5 x 470K ½ watt; 4 x 1M ½ watt; 2.2M ½ watt.*

1 per cent H.S. type: *5K, 10K, 22K, 56K, 120K, 330K, 2 x 1M.*

Potentiometers: *5K linear tab; 10K linear tab; 2 x 20K linear; 50K linear tab; 100K linear; 100K linear with switch; 1M linear; 1M linear with switch.*

MISCELLANEOUS

2 *x 560uH peaking inductor; 2.5mH RF inductor; 5 x miniature 9-pin valve sockets; co-axial input connector; 3 red screw terminals, 2 black; 2 midget knobs, 3 small knobs, 2 bar-type knobs; handle and rubber feet; mains cord and plug; miniature resistor panel — 2 x 12-lug lengths, 9-lug length, 6-lug length, 3-lug length; 2 x min. 3-lug tagstrips; 2 x 7-lug tagstrips; nuts, bolts, solder, varnished cambric sleeving, etc.*

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Noise	Minus 60 DB	"
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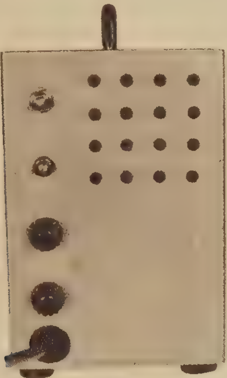
vertical input connector. The rotor lug of the latter switch should be adjacent to the screw nearest to the input connector.

After mounting the chassis to the front panel the shield plate may be fitted, followed by the remaining controls (including tab pots). The input connectors, tube hood graticule, and knobs may all be fitted at this stage also.

The valve sockets should then be mounted, and after these the tagstrips and resistor panels. Depending upon the preference of the builder these may be wired with their minor components before being fitted, or fitted and then wired; either way, assembly will be fairly easy. And finally, after mounting the remaining components and completing the wiring, the tube may be added.

If the tube is added before the vertical amplifier is wired the job is not only made more difficult, but there may be a risk of jarring the tube and damaging it.

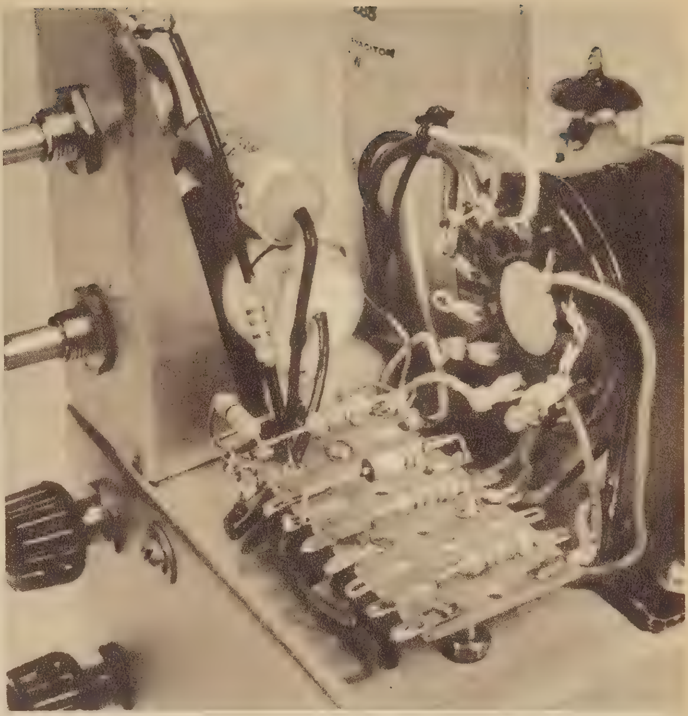


With the assembly completed the instrument is set up and calibrated in the following manner. Before switching on, turn **all** the preset tab pots fully clockwise and the trace positioning, focus and astigmatism controls to the centre of their rotation. Similarly turn the switch fully anticlockwise until it clicks to "Auto," and the timebase variable control fully clockwise to "Cal."

With the vertical attenuator switch set to 0.5V/cM and the two timebase switches set to give 20mS/cM (i.e., 10mS/cM and x2), connect the instrument to the power mains and with a small length of wire connect the vertical input to the "Cal" terminal. When the instrument warms up this should produce a somewhat spiky and rounded square wave trace, representing the calibrate signal.

Before proceeding further, adjust the focus and astigmatism controls and the trace positioning controls for a properly centred and sharp trace. The focus and astigmatism controls will be found somewhat interdependent; however, by a series of successive approximations the correct setting for each should be found quite easily. If the brightness seems either excessive or inadequate, the tube cathode resistor may be altered in value as previously explained.

At this point the calibration signal should ideally be checked with an exernal standard or instrument to ensure that it is in fact 1V peak-to-peak. The easiest way to do this is with another calibrated oscilloscope, however if this is not feasible a VTVM may be used. The reading given by the VTVM for 1V p-p will be approximately 0.49 volts RMS.



Above is a detail shot of the tube and EHT supply wiring. The second diode is obscured behind a capacitor. At left is a view of the rear of the case.

If the calibrating voltage differs from the correct value, it should be corrected by altering the value of the resistor shown as 3.9K. The voltage will be directly proportional to resistor value.

With the calibration voltage checked, the next step is to use it to set the vertical sensitivity and timebase calibrations. As the control switches have already been set to correspond to 0.5V/cM and 20mS/cM, this simply involves adjustment of the two appropriate tab pots with a screwdriver. Adjust the "vert. cal" pot to give a trace height of 2cM between the flat portions of the waveform, and the "time cal" pot to make each cycle of the signal occupy 1cM horizontally.

Make sure when carrying out the latter operation that the variable time control is fully clockwise in the "cal" position. Otherwise the time calibration will be useless.

Apart from small errors due to within-tolerance component variations, wiring capacitance and non-linearity of the timebase, the above calibration procedure should result in quite accurate calibration on all ranges of the vertical attenuator and timebase.

Three more operations are ideally required before the instrument is ready for use: adjustment of the vertical attenuator frequency compensation, adjustment of the trigger compensation trimmer and adjustment of the "trig sens." pot. Of these the latter two are most easily carried out, while the former may present problems.

To adjust the "trig sens." pot, connect the vertical input to the calibration terminal and set the input attenuator to the 5V/cM range; this will give a trace approximately 2mM high. Back off the tab pot until synch. is lost (anticlockwise) and then advance it until synch. is restored to give a steady and jitter-free trace. Do not advance the control further than required for reliable synching on a trace 2mM high, as this makes the trigger unduly sensitive to HT ripple, line transients, etc.

The foregoing operation should be done with the trigger compensating trimmer set to near-minimum (out of mesh). When the tab pot has been set the trimmer may be slowly increased in value until the trace shows evidence of erratic triggering (caused by trigger

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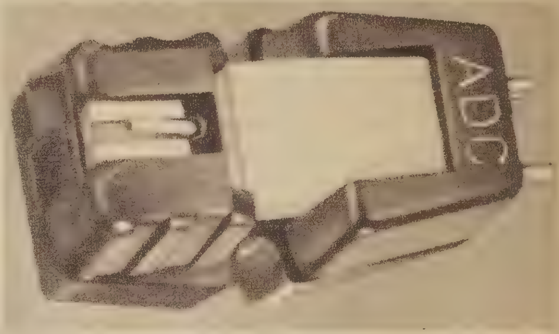

The “family” of ceramic playback heads fills, no doubt, a very well deserved gap for commercial and moderately priced audio equipment. Whilst it must be admitted that the very best of these heads (particularly if they can be “hand-picked”) are capable of a good performance, there can be no shade of a doubt, that the magnetic cartridge is, decidedly, king for today and, most probably, tomorrow too.

Strain-sensitive cartridges can be divided into two groups, viz. (a) the stress-generator and (b) the stress-modulator types. In the former, the pressure on a ceramic substance generates the signal, in the latter, pressure is exerted on a silicon element varying its resistance to an external current flow. Both types work basically on exactly the same principle, viz., the motion of the stylus is transmitted via a coupling yoke to a generating or modulating element, which has to be compressed and stretched.

Advertising copywriters refer today to such units as “solid-state” transducers, which does sound rather impressive. In fact, however, this term could have been applied to the good old crystal cartridge of many years ago, as in today’s electronic parlance the expression simply refers to all components that are “‘solid” throughout, such as a transistor, a semi-conductor diode, a crystal or ceramic element, etc., etc., as opposed to a valve, which contains a vacuum.

Unfortunately, **all** stress-generator and modulator cartridges currently available on the world market suffer from the following “handicaps” and, as pickups are certainly our business, these findings have also been substantiated by our own independent and extensive tests:—

(1) The complexities involved are very considerable in getting a durable mechanical system expected of a high performance, modern playback head.

(2) Even the very best designs suffer from resonances, which have to be critically damped, while the multitude of parts has its mass reflected in the total mass seen at the stylus tip; notwithstanding various advertising claims, the mass of the moving system is considerably higher than that of even an average, good quality magnetic cartridge.

(3) They are amplitude sensitive, which means response would be flat (at least theoretically) if discs were recorded at constant amplitude. For technical reasons, however, this is not so and, consequently, three octaves of the bass band of today’s modern records have a constant velocity characteristic, which includes the important midrange from 500 to 2120 cps. Stress generators and modulators must, therefore, rely on 17 db of mechanical equalisation. Maintaining consistent performance of the finished product is a very well known problem, extremely difficult to overcome in production, which is further aggravated by the fact that the compliant linkages between cantilever and element beam (and of the element beam itself) are temperature sensitive.

By comparison, the stylus mechanism of all magnetic cartridges is substantially lighter, extremely simple and mechanically sound. Correct and stable RIAA equalisation is electronically achieved by R-C networks provided in all modern amplifiers which have ample gain and no hum problems.

And, we almost forgot, may we suggest that you audition ADC cartridges before you make your final decision. They employ the patented INDUCED MAGNET PRINCIPLE. This, audio experts believe, represents the furthest practical limit in high fidelity cartridge design of today. Let your ears prove it for themselves!

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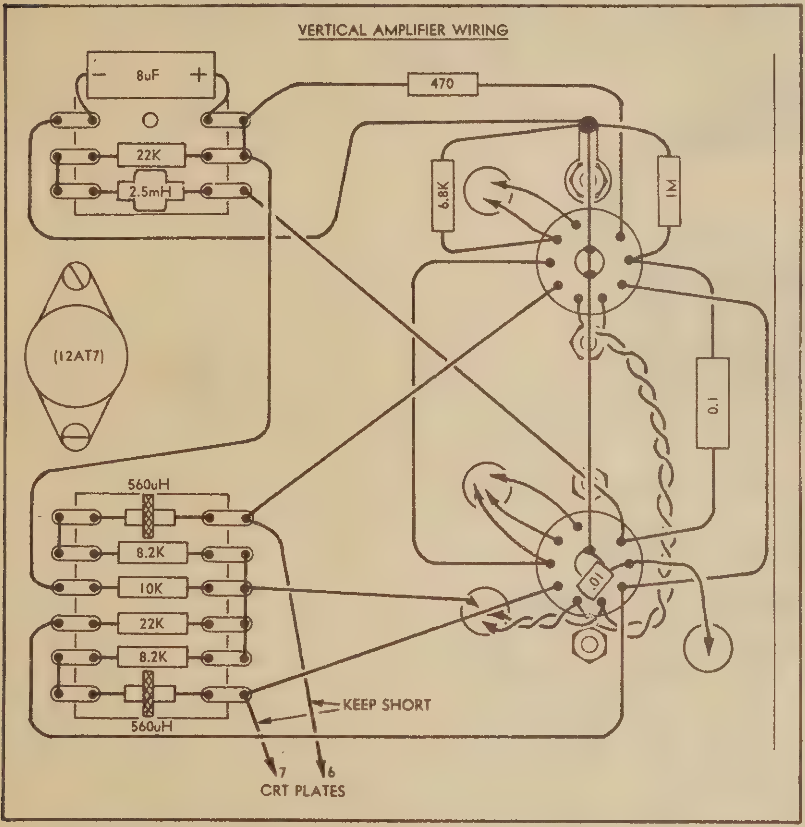
ringing), and then backed off until this effect disappears. The trigger is then set for optimum performance.

Adjustment of the vertical attenuator compensation can only be done by means of a pulse or square-wave generator with a known fast risetime and neglible overshoot or ringing. If such an instrument is not available, it would be best to set the attenuator trimmers to about mid-position and accept any small errors which may result.

If a suitable instrument is available, however, the procedure involved in setting the trimmers is quite straightforward. First switch the attenuator to the 200mV/cM position, adjust the generator for a trace height of about 2cM and set the trimmer across the 1M series resistor to reproduce the pulse or square wave accurately. Too low a setting will produce rounding of the waveform corners, while too high a setting will produce overshoot; the correct setting should be obvious as that which produces a sharp, square waveform.



A wiring diagram of the vertical amplifier circuitry above the chassis, beneath the tube. Keep all signal leads short and direct.

With the series trimmer adjusted the other trimmers may then be set by switching to the appropriate range, adjusting the generator for a convenient trace height and setting the trimmer as before. Note that the 100mV/cM range requires no compensation as it is governed solely by the amplifier itself; also note that once the series trimmer is set it should **not be touched** as it will disturb the compensation of all ranges apart from the 100mV/cM range.

When all the trimmers are set, it is a good idea to cement them in place with nail lacquer to prevent them from drifting due to vibration. This applies both to the vertical attenuator trimmers and to the trigger compensating trimmer.

The instrument will now be calibrated and ready for use.

Before closing, a few words about test probes: both the 100:1 and 10:1 divider probes described for use with the 1963 instrument are quite suitable for use with the new design, and are recommended where measurements must be made in high impedance circuits. The only change required to the probes as originally described is the use of a coaxial output cable connector rather than the four-pin connector originally used.

If it is required to achieve low circuit loading with zero signal attentuation, a cathode-follower probe will be required. To use such a probe with the new instrument an external power supply is required, as was the case with the 1963 instrument.

For details regarding both divider and cathode-follower probes along with details of a x10 and x100 preamp/power supply, readers are referred to the September, 1963, article "A Wide-Band Preamp with Matching Test Probes."

For those who require a demodulator or detector probe for TV or other applications, a unit of this type was described in the article of September, 1960, entitled "High Performance 3-inch CRO: Part 2."

And finally, for applications where it is necessary to examine and measure very low level signals in the range 30cps-20KC, readers are referred to the recent article "Probes for the 1966 VTVM" (March, 1966). ■

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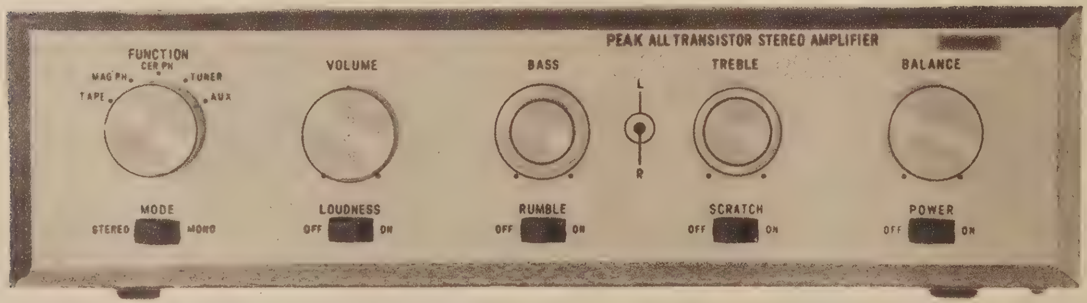

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Frequency Response	20 — 20,000 c.p.s. ± 1 db.
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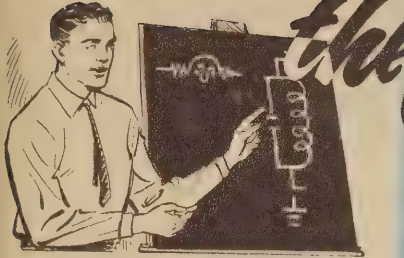

the "Answer Man" Explains

About magnets and supermagnets

A question from a reader about magnets and super-magnets reminded us of a lecture on the subject given some time ago over the BBC by Nicholas Lloyd. With minor modifications, the original script answers the question very well.

Most text books contain an explanation of ordinary magnets and the part they play in the compass, generators, meters, etc. But what is meant by the term super-magnet? Is this just a bigger than usual ordinary magnet?

Most people are fascinated by magnetism. Most have observed that a magnet will pick up objects made of iron or steel, but have no apparent influence at all on, say, a brass pin. They may even have progressed to the famous experiment in which iron filings are sprinkled on a piece of paper which has been placed over a magnet. The filings promptly jump to life and form a pattern which indicates the lines of the magnetic force.

For the great majority of people this "conjuring trick" is virtually the end of the story. Yet, according to one authority, magnetism is more important to our material well-being than atomic energy—and this will still be so in 20 years' time. Half the important advances in physics of the past 60 years have depended on experiments in which magnets played a vital part. Without magnetic tools there would be no electricity supply, no modern computers—and no atomic bomb. In fact the earth itself is one vast magnet.

Having said all this it is not surprising that scientists are for ever demanding bigger and better magnets.

Permanent magnets made of iron and various alloys—the type which schoolboys carry in their pockets—will not provide the intense magnetic fields which scientists are now seeking, however large they are. So it becomes necessary to turn to electromagnets in any such search.

The electromagnet relies on the fact that an electric current flowing in a wire produces a magnetic field. This means that an electromagnet can be simply a coil of wire through which a current is passed, though frequently a core of iron is placed in the centre of the coil to concentrate the magnetic field. The intensity of the field depends largely on the strength of the current.

However, there are limits to the power even of electromagnets. One limiting factor is overheating in the wire coil, which is caused by the resistance of the wire to the current flowing through it. In big magnets this has to be overcome by some cooling device. An ingenious solution which has been used is to make the coil out of copper tubing, and allow cooling water to flow inside it. Another problem is providing the power supply to deliver electric currents of sufficient magnitude. Enough current to keep several thousand electric fires burning may be needed—all concentrated into one wire.

The strength of a magnetic field is measured in units called gauss, and powerful electromagnets working today produce field strengths of 100,000 gauss or more. This compares with the earth's magnetic field of one gauss. Actually, scientists are interested in field strengths of 250,000 gauss and over but achieving such an enormous field strength demands highly refined techniques.

Some of the heating problems, and the problem of supplying sufficient power can be overcome if a magnetic field is required only for a short time. An enormous jolt of current can be blasted down the coil just for an instant. When the current ceases, the coil cools down. Fleeting magnetic fields of this type can be very useful but they will not do for every purpose.

Another idea is the superconducting electromagnet. A superconducting material is one in which resistance to an electric current disappears when the material is reduced to a very low temperature, close to absolute zero. In an electromagnet coil made of superconducting material, the heating problem largely disappears, since the cause of heating is resistance. In addition far less power is needed, because the less resistance there is, the greater the current will be.

In fact, using super-conducting materials it is feasible to achieve a magnetic field of 70,000 gauss with only a 2 volt accumulator.

The problem with the superconducting magnet is the expensive refrigeration plant which is needed to keep the coil at a very low temperature. Even so, superconducting magnets may be lighter, less bulky and even cheaper than the conventional kind for some applications.

The obvious question is: Why go to all this trouble? What do the scientists want these huge and expensive magnets for? Well, there are plenty of applications—particularly in atomic research.

One dream is to obtain power for peaceful purposes by making light atoms fuse together. This is the way in which the power of the Sun and the H-bomb are obtained. It involves raising light gases to extremely high temperatures—about 10 million degrees—so that the individual atoms are accelerated to high speeds and crash into each other. One of the biggest problems is keeping the gas all in one place when it gets very hot. But it can be done by applying a powerful magnetic field. The magnets deflect the atoms away from the walls of the vessel which contains them and hold them in a sort of invisible magnetic bottle.

Very large magnets are also needed in particle accelerators. In these machines, charged atomic particles are accelerated to enormous speeds so that they can be used as atomic bullets to crack open other atoms and discover what they are made of. Magnets are used not only to speed up the bullets but also to keep them going in the right direction.

Magnets can also be used to measure the intensity of cosmic rays coming from outer space. As mentioned, magnets will deflect charged atomic particles from their course and, by measuring the degree of deflection, it is possible to calculate the amount of energy that is driving them along.

Besides these applications to fundamental research there are plenty of practical jobs which bigger and better magnets could do. One possibility is producing electricity directly from heat by a process known as magnetohydrodynamics. This could add 20 per cent to the efficiency of power stations. Better magnets would also be useful in those new devices, masers and lasers, which have many applications particularly in communications.

It may even become possible to explain what magnetism is, for, although a great deal is known about it, fundamental questions still remain to be answered.

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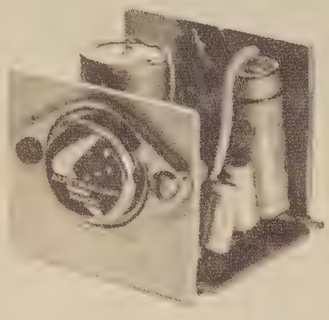

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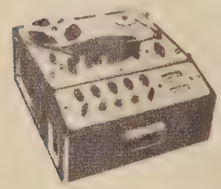

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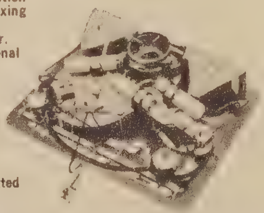

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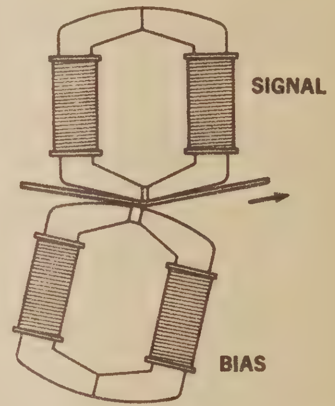
What is meant by the term CROSS FIELD BIAS, as applied to tape recording?

In conventional tape recording, both signal and bias voltages are applied to the same recording head. Since one of the characteristics of such a high frequency is that it tends to erase signals from the tape, particularly at the high frequency end of the spectrum, there is a tendency for the bias to erase the very signal it is being used to record.

A practical example of this is seen when excessive bias is applied to a conventional recording head; the result is attenuation of the high frequency signals. On the other hand, it is essential that adequate bias be applied, otherwise the recording level will be poor and the distortion high. In practice, therefore, a compromise level must be selected somewhere between these two limits.



In the cross field bias system, recently developed by one of the larger tape recorder manufacturers, two separate heads are used, one fed with the signal voltage and the other with the bias voltage. They are mounted on opposite sides of the tape, with the gaps slightly offset, as shown in the accompanying diagram. (Reproduced from the manufacturer's literature).

Developers of this system claim that it minimises the problems associated with the conventional arrangement, allowing much better high frequency response for a given order of head gap and tape speed.

The precise behaviour of the magnetic fields and the manner in which the improvement is achieved appears to be quite complex, and a full explanation of all that is involved is beyond the scope of this discussion. However, it is significant that those recorders employing this system do exhibit substantially better high frequency response than would normally be expected from the tape speeds involved.

What bias and erase frequency is used in video tape recording? Considering that the signal frequencies may extend to 5MC or higher, it would seem that the conventional 50 to 70KC used for audio systems would be quite useless, and that a much higher frequency would be needed. Is this correct?

It is not possible to give a complete answer to this question, since a number of quite different video tape recordings have been developed, tried, or suggested. Some have been successful, some show promise, and some have fallen by the wayside.

At commercial level by far the most widely used system is that developed by Ampex and which uses four rotating heads, spaced in quadrature, which scan transversely a 2in wide tape travelling at the conventional 15ips. Because the head assembly can be made to rotate at high speed (15,000 r.p.m.) the effective tape speed is very high, around 1500ips, which is essential to handle the high signal frequency.

Probably next in popularity is the helical scan system, also developed by Ampex, which uses a single head which scans obliquely across a wide tape. This is a (relatively) cheap system, designed for use in industry, education, drama instruction etc, where the cost of the more elaborate machine cannot be justified.

For the purpose of this discussion we will consider the first of these two systems, although much of what is said also applies, in a general way, to the helical scan system.

In fact, no bias signal is used, since the method of recording is rather different from that used in audio systems. While at first glance it may appear that, having achieved a very high effective tape speed, it is simply a matter of feeding the video signals to the recording heads in what amounts to a speeded up version of audio recording, there are a number of reasons why this would not be successful.

One of these, for example, is the very real problem of matching the sensitivities of the four heads. No matter how carefully they are made, it is virtually impossible to match them — and keep them matched — with sufficient accuracy to prevent noticeable changes of contrast as each head scans the tape. This would give rise to horizontal bands of picture differing in contrast from those above and below.

To overcome this and other problems, the video signal is used to frequency modulate a carrier, the latter then being recorded. As in any frequency modulation system, this renders the signal immune to amplitude changes, since the latter can be effectively eliminated by suitable limiters in the replay circuit. Further limiting is provided by deliberately arranging the recording amplitude so that the tape is driven to its saturation point.

In the same manner, it renders the signal immune to the amplitude distortions normally introduced by a tape which is not suitably biased. Thus, no bias is necessary.

As a matter of interest, there are two standards currently in use for this form of recording; the old, or "low band," system and the new, or "high band," system. The latter was introduced quite recently, as a result of the improved tape and head designs which have had such a marked effect on the performance of audio recorders.

The low band system uses a carrier frequency of about 5.5MC, with a deviation ranging from 5MC for the synch tip level, to 6.8MC for the peak white level.

The high band system uses a carrier of 8MC, with 7.14MC as synch tip level and 9.3MC as peak white.

Both systems are capable of excellent results, as far as the viewer is concerned, but the high band design has the advantage that, by making a marginally better quality recording in the first place it allows better quality copies to be made, even where third generation dubbings are involved.

The high band system is also ideally suited to colour TV recording, which was one of the major reasons for its development.

The helical scan system also employs frequency modulation but, because of the lower effective tape speed (around 600ips), a lower carrier frequency must be employed. The deviation in this case is from 3.4MC for synch tip to 4.7MC for peak white.

Finally, how is the tape erased?

It can, of course, be treated in a bulk eraser, in a similar manner to that sometimes used for audio systems. However, this is not a very convenient arrangement, and all modern video recorders are equipped with an erase head in front of the recording heads. This is fed from a 100KC oscillator.

Normally, the erase head does not cover the full width of the tape but is deliberately designed to clear the audio track on one edge. The audio track has a separate record head. This permits editing the video section of the tape, by erasing and rerecording, without disturbing the sound track, should this be desirable. ▬

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SIMULATION

(Continued from page 14)

punctures, and sub-system reliability) is estimated to be about 56 per cent.

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Eventually, Boeing engineers hope to ntegrate man and machine for the simulated interplanetary flights. The simuation would be run in fast time in the :omputer (200 missions in three minu:es) until a failure occurs. At the time)f failure the mission would convert to 'eal time simulation and the computer vould select from stored information hose indicators which would be shown vithout prior warning to a space pilot n a space flight simulator. His action :ould save the mission — or confirm an ıbort.

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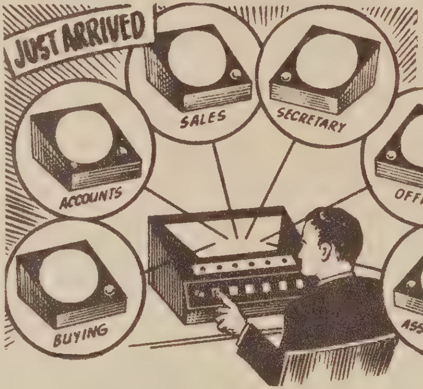

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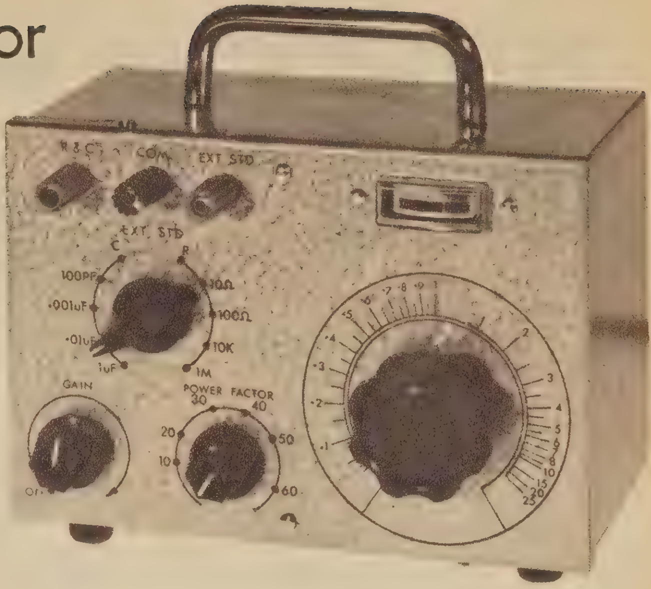
A New, All-Transistor R-C BRIDGE



This new Resistance — Capacitance Bridge should prove to be a worthy addition to our present growing range of small pieces of test equipment. Smaller than bridges which we have described in the past, it is also the simplest but will perform practically all the functions of its predecessors.

By Ian Pogson

The last Resistance — Capacitance Bridge to be described, was in September, 1963. This unit used a 12AT7 amplifier valve and a 6X4 rectifier, with an EM34 "magic eye" as the null indicator. Needless to say, this arrangement is capable of doing the job in a very satisfactory manner.

However, progress dictates that the same job should now be done with less space and preferably with less complexity. The new unit has a three transistor amplifier, with a germanium diode rectifier and a small meter movement as the indicator. This arrangement dispenses with thermionic valves and so keeps heat dissipation and space requirements to a minimum.

Eight ranges are provided altogether; four for capacitance and four for resistance. Accurate measurements of resistance may be made from less than half an ohm up to 25 megohms. Similarly, capacitance measurements may be made from one picofarad or so (more about this later) and 25 microfarads.

It will be noted that there were only three ranges each for capacitance and resistance measurements on the 1963 version of the R-C Bridge. The extra ranges which are now provided are not of prime importance, but do give the facility of measuring resistance and capacitance in the middle values to a somewhat greater degree of accuracy.

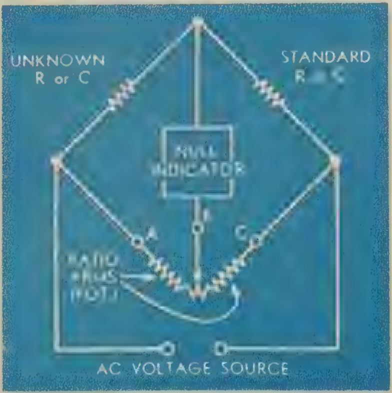
The facility is also provided to observe the power factor of capacitors in the two higher ranges. This can be very useful in checking old, high-value paper capacitors from the junk box. If the power factor is too high, compared with a new one of the same capacitance, the capacitor should be discarded.

In addition to the four ranges for capacitance and resistance, terminals and switching are provided for an external standard. This allows the introduction of a standard into the bridge circuit of a different value than those built into the instrument. By this procedure, quite high values of resistance and capacitance may be measured. It should also be noted that the external standard need not be a multiple of ten. Rather is it necessary to know the exact value of the standard and then the **ratio** may be read off the calibrated scale. The unknown is then the value of the standard, multiplied by the ratio.

The principle of operation of the bridge has been given before but, for those readers who are not familiar with it, we will run over it briefly again.

Reference to the circuit will show that it is based on the Wheatstone bridge. This is a balanced arrangement with four resistive arms and enables an unknown resistor to be compared with a known standard. This may be done either by varying the standard resistor against a calibrated scale (being calibrated potentiometer or decade box), or by using a fixed standard and varying the ratio of the other two arms, against a calibrated scale, to determine the ratio of the unknown resistor to the standard.

For the purpose of this discussion, the four arms of the bridge can be considered as making up the four sides of a square as shown in the basic circuit. The voltage source is applied to the right and left hand corners of the square, while the indicating device is connected across the two remaining corners.



This is basically a Wheatstone bridge, upon which our practical bridge is built. Its principle of operation is described in the text.

When the ratio of the unknown to the standard is the same as the ratio of the left hand side of the ratio arm (A-B) to the right hand side (B-C), a state of balance is established. If the unknown should be equal to the standard, then balance is achieved when the ratio arms (A-B and B-C) are of equal value.

Equal voltage drops will occur across all four resistors in this latter condition and there will be no potential difference between the points to which the indicating device is connected. The bridge is then said to be in the "null" condition.

When the value of the unknown differs from that of the standard, the ratio arms will, at balance, take up the same ratio that exists between the unknown and standard and, as before, there will be no potential difference across the indicating device.

If three of the four values are known, then it is possible to calculate the value of the fourth. It is also true that if we know the **ratio** of the two values, along with a third, it is possible to obtain the fourth.

It will now be clear that, by using a potentiometer with calibrated scale for the ratio arms, and selectable standards (of known value and tolerance) as the third value, it is possible to measure the actual values of "unknown" components over a very wide range. To do this it is necessary to calibrate the dial of the ratio potentiometer in terms of the ratio of resistance on the left hand side of the moving contact (A-B) to the resistance on the right hand side (B-C) for all positions of the moving contact over its full rotation.

As the bridge is a symmetrical circuit, accuracy is not upset by changes of voltage or sesitivity of the null indicating device.

Where the bridge is to measure only resistance, the voltage source may be DC consisting of a series of dry cells, though an AC source may be used. However, in order to measure capacitance, it is essential to use a source of alternating current. The same balance conditions will apply, regardless of whether the two upper arms of the

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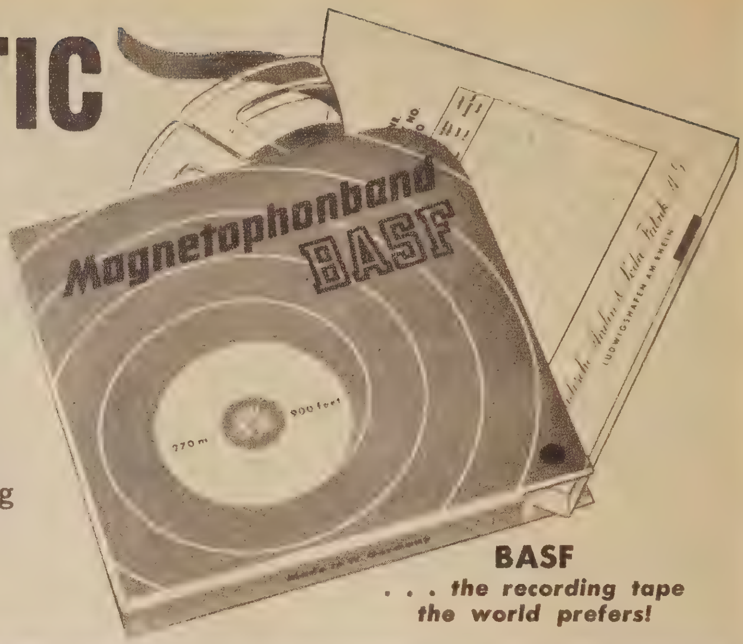

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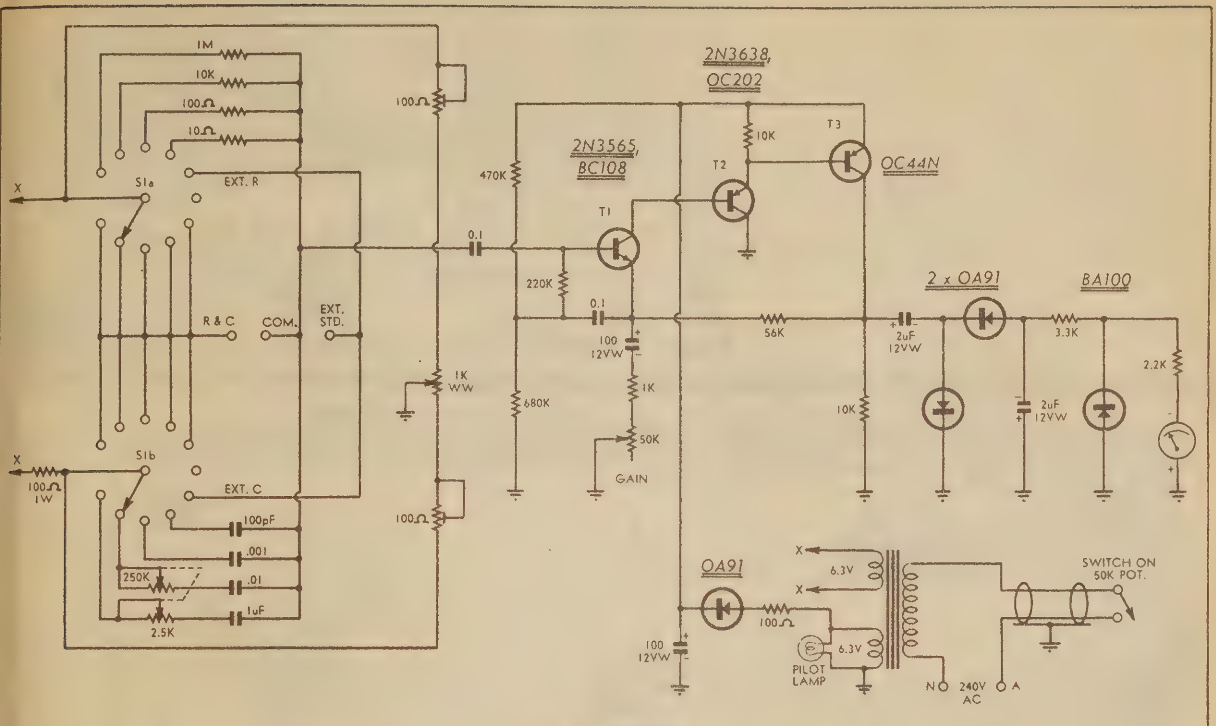

1966 R-C BRIDGE

The actual bridge network is much the same as previous models but the rest of the circuit is quite different in that a transistor amplifier is used, together with a small meter for the null indicator. Note the silicon diode to protect the meter.

bridge are a pair of resistors or a pair of capacitors. The ratio between them can still be balanced by a similar ratio of A-B to B-C.

When testing capacitance, a suitable capacitance standard is selected and the ratio of the reactances of the unknown to the standard is obtained from the calibrated ratio scale as previously. In the cases where either of the two larger standards are used, any shunt resistance which may be present in the capacitor under test, is nulled by use of a separate potentiometer in series with the standard capacitor. This is the power factor control which will be discussed later.

It should be noted that capacitive reactance is inversely proportional to the capacitance value. This means that the ratio arm scale would need to be in the reverse direction to the resistance scale. By changing over the positions of the standard and unknown with the switch, this problem is overcome and the readings can still be taken from the one scale.

The AC source can be of any convenient frequency with 50 and 1000 cps being the most popular for this type of unit. In our case, 50 cps is most convenient, as this may be obtained from a heater winding on the power transformer.

Where a DC source is used, the null indicator could be a sensitive centre-zero galvanometer. However, such an instrument is expensive and delicate — consequently considerable care must be exercised in its use. For obvious reasons, this type of indicator is not suited to our purpose.

If the voltage source is AC, at a frequency around 1 or 2KC, then a pair of headphones may be used as the null indicator. The problem here is that headphones are not sensitive enough and they are rather inconvenient to use.

The "magic-eye" proved to be ideal for our previous bridge. A source of high tension was available for its operation and it is not possible to damage it due to overload.

For our new bridge, the magic-eye indicator is not suitable as there is no source of high tension readily available and so we must look elsewhere for a suitable indicator.

We have chosen a small rectangular shaped meter which fits the panel conveniently and has worked out very well in practice. As we are using a source of AC for the bridge, we must provide a rectifier and filter to convert the AC signal to DC, so that it will operate the moving coil meter.

The sensitivity of this meter is not sufficient of itself and so we must provide an amplifier. As an added operating convenience, a gain control is provided although it will be found that it will not have to be used very much.

Referring now to the circuit of the complete instrument it will be seen that it is about as simple as it could be for the functions it will perform.

The bridge is conventional but with the necessary switching to bring the needed standard into circuit. As mentioned earlier, a power factor control is introduced in the form of a ganged potentiometer, a 2.5K section being introduced in series with the 1uF and 250K in series with the .01uF standard.

The power factor control works on the principle that the loss in a capacitor can be represented by a certain value of resistance in series with it, and which can be balanced out by a variable resistor in series with the standard capacitor.

This control is calibrated on the basis that power factor is the ratio of resistance to impedance. For a given value of resistance in series with the standard capacitor, the power factor of the unknown capacitor can be calculated. Divide this resistance value by the square root of the sum of the square of this resistance value and the square of the reactance of the standard capacitance. The result is multiplied by 100 to give an answer in percentage.

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MARCONI INSTRUMENTS

Transposition of the equation will arrive at a value of resistance for various percentages of power factor in steps of 10. The potentiometer values chosen will accommodate readings of up to 60 per cent.

The 1K potentiometer which forms the ratio arms, should be of a good quality wire-wound type. We used a Naunton 2-watt type, which is about the minimum which could be used, consistent with satisfactory linearity. If better accuracy is desired, then the Naunton 5-watt type may be fitted. This is somewhat larger but there is ample room to accommodate it.

At each end of the ratio potentiometer is a 100 ohm wire-wound adjustable resistor. These enable the scale to be calibrated correctly at each end.

The standard resistors and capacitors are really the heart of the instrument and the accuracy of measurement depends in the first place on how close these items are to the true value. In other words, the tolerance. Needless to say, the closer the tolerance, the higher will be the cost.

High stability, 1 per cent tolerance resistors are reasonably priced but if the utmost economy is desired, then it is possible to buy readily available cracked carbon resistors in 5 per cent tolerance, in at least one brand. These cost in the the vicinity of 10 cents each and can prove to be satisfactory for all but the more exacting requirements.

In the case of the capacitors, close tolerance units particularly in the larger values, can be really expensive. The 1uF capacitor is available at least in limited quantities, in a polystyrene type, with a tolerance of 1 per cent. However, the cost runs into several dollars. We fitted our unit with standard stock lines of polyester types for the 1uF and the .01 uF with a 10 per cent tolerance. The .001uF is a 2½ per cent polystyrene and the 100pF is a 5 per cent silver mica. Under calibration, we found it necessary to shunt the 100pF with a 5.6pF NPO ceramic.

Finally, as far as the bridge proper is concerned, the input is fed from a 6.3 volt AC source on the transformer and via a 100 ohm resistor. This resistor is fitted to limit the maximum current flow under conditions when low values of resistance are being measured. If this precaution were not taken, it would be possible to exceed the ratings of low values of resistors. The output of the bridge is fed into the amplifier.

The amplifier consists of three transistors, capable of giving more than sufficient gain in most cases, with always sufficient when measuring low values of capacitance and resistance. The first stage is arranged in a "bootstrap" arrangement and transistor types 2N3565 and BC108 are suitable. The second stage may be fitted with a 2N3638 or an OC202, while an OC44N is used in the output stage. A feedback loop runs from the emitter of the output to the emitter of the input transistor. The amount of feedback is adjustable by means of the 50K potentiometer in the first stage emitter, thus performing the function of gain-control.

Following the amplifier is a voltage doubler rectifier consisting of two OA91 diodes and two 2uF electrolytics. The recovered DC is fed into the meter indicator network.

The 3.3K and 2.2K series resistors function as a meter multiplier more or less in the usual manner. However, it is possible to overload the meter, thus slamming it hard against the stop. To avoid this, we have incorporated a protective device in the form of a silicon diode. This is arranged so that it will conduct at a pre-determined level. By shunting the meter with the diode and introducing a certain amount of resistance in series with the meter, it is possible to make the meter reading cut off at any pre-determined deflection.

It will be noted from the circuit that we have used 2.2K in series with the meter, with the diode shunted across them. This, together with the 3.3K resistor in series as well, combines to allow the meter to swing not quite to full scale. This arrangement has proved to be ideal in practice.

The actual amount of maximum current passed by the meter and so the extent of the needle deflection, will depend on the turn-on characteristic of the particular diode which happens to be used. This can vary over quite a considerable range and the condition can be met by adjusting the value of the 2.2K resistor. If the meter does

PARTS LIST

1 Instrument case, 7½in x 5in x 4in, with front panel.
1 Pilot lamp bracket.
1 Handle for case.
1 Meter 200uA, type No. V303.
1 Power transformer 6.3V, 6.3V.
1 Rotary switch, 2-section, 1-pole, 11 positions per section.
1 Transistor, BC108, TN3565.
1 Transistor, OC202, 2N3638.
1 Transistor, OC44N.
3 Germanium diodes, OA91.
1 Silicon diode, BA100.

RESISTORS

10 per cent tolerance.

1 100 ohm 1W.
1 1K ½W.
1 2.2K ½W.
1 3.3K ½W.
2 10K ½W.
1 100 ohm ½W.
1 56K ½W.
1 220K ½W.
1 470K ½W.
1 680K ½W.

High stability, close tolerance (see text).

1 10 ohm.
1 100 ohm.
1 10K.
1 1M.

POTENTIOMETERS

2 100 ohm wire wound, slider type.
1 1K wire wound (see text).
1 50K curve "A," with rotary switch.
1 250K curve "A" plus 2.5K curve "A," ganged.

CAPACITORS

2 0.1uf low voltage, plastic.
2 2uF 12V electrolytic.
2 100uF 12V electrolytic.

Close tolerance (see text)

1 100pF.
1 .001uF.
1 .01uF.
1 1uF.

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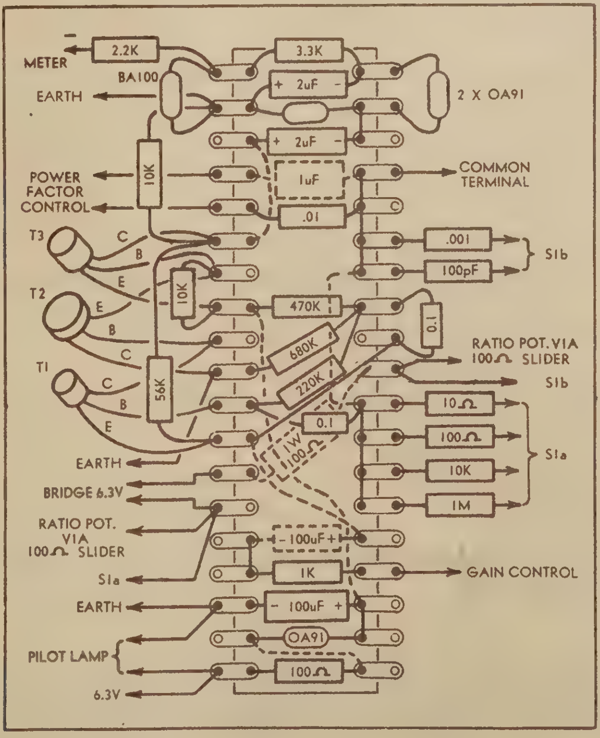
1 Miniature tag-board strip with 19 pairs of tags.
1 Pilot lamp socket.
1 8-tag strip.
1 6.3V pilot lamp.
3 Insulated terminals, one black, two red.
4 Rubber feet.
1 Rubber grommet.
4 Knobs.
2 Spacers 1½in long (see text).
Power cord, 3-pin plug, hook-up wire, 2-core shielded lead, tin plate, screws, etc.



Readers would be wise to wire up the tag board as shown here. The layout is such that components are conveniently placed with respect to points external to the board.

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BP5 "	"	"	2.5 Amps	500	$17.25
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SB10 "	"	"	10.0 Amps	2000	$45.25
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not travel far enough across the scale, the 2.2K resistor should be reduced. If the reverse is the case, then the 2.2K resistor should be increased. Where considerable change is made in the value of this resistor, then the 3.3K resistor should be changed so that the total resistance in series with the meter remains about the same.

The meter which we used in our prototype is available from Electronic Supplies, Box 417, P.O., Crown Street, Sydney, either direct or through local parts suppliers. The type is No. V303 and is as illustrated on page 118 of the issue for March, 1966. FSD sensitivity is 200uA.

Although we have not tried the idea, it should be possible to use a meter of lower sensitivity, if this should be readily available. Movements up to 1 milliamp would be well worth a trial. It should go without saying that the series resistors would have to be reduced accordingly. The ratio between the two resistors would remain about the same, but they would still have to be adjusted to suit the protective silicon diode, as previously described.

The power supply is about as simple as it could be. An OA91 diode is used as the rectifier, with a 100uF electrolytic for the filter. A 100 ohm resistor is added in series with the diode to protect it from surges when the power is switched on. A 6.3 volt pilot lamp is fed from the same winding on the transformer. A second 6.3 volt winding on the transformer provides a separate supply for the operation of the bridge circuit.

The complete unit is built into one of our new small "standard" instrument cases, measuring 7¼ inches by 5 inches by 4 inches. The small rectangular indicator meter is mounted in the top right hand corner, with the scale and knob for the ratio arms immediately below.

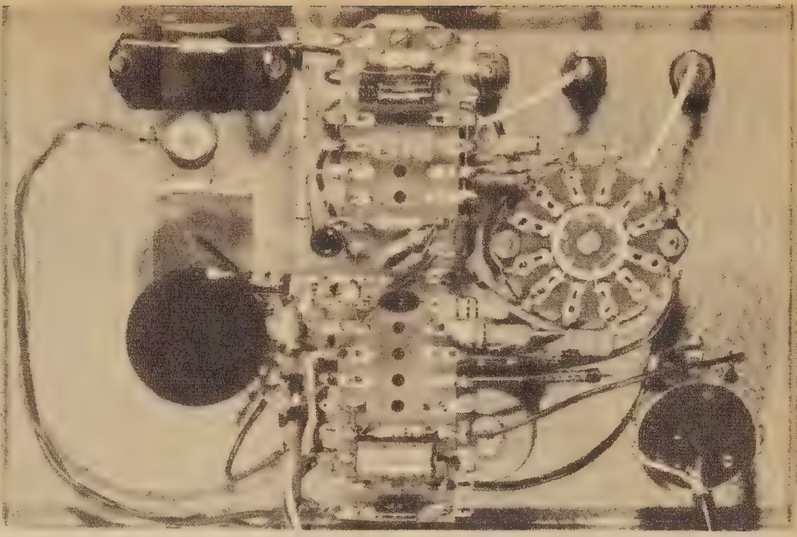
Three terminals only are provided at the top left of the panel. These terminals consist of a "common," with the "R & C" unknown on the left and one for an external standard on the right.

Immediately below the terminals is the standards selector switch. The gain control is at the left bottom corner, with the power factor control alongside it.

Drawings are being prepared in the usual way and it should be possible to purchase all the metal work, ready punched, either directly from the makers or through local parts suppliers. In addition, we are making available a printed scale, which may be obtained through our Information Service for 20c each.

From a construction point of view, it is difficult to imagine how it could be made much simpler. There is plenty of room for all components and all items are easily accessible. Most of the small components are mounted on a miniature tag board, as will be seen from the photographs. This board is stood off the panel with 1¼in long brass spacers. Ours were made up from lengths of 1in and ¼in. All items are mounted on the front panel, except the power transformer and the terminating tag strip, which are located on the bottom, towards the back of the box.

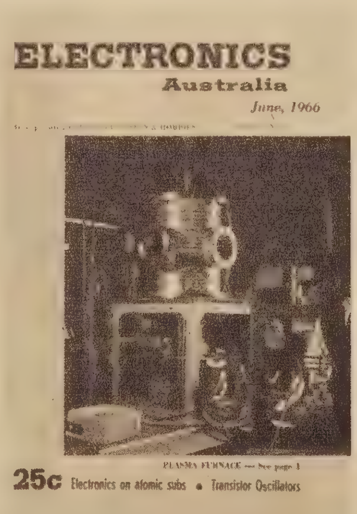
Wiring is not critical but we do suggest that the wiring diagram for the tag board be followed. This follows a logical sequence and makes for short leads and convenient wiring between the board and other components.



This view is of the rear of the front panel, on which most of the components are mounted. The tag board in the centre, is stood off with 1¼in spacers. The meter, ratio potentiometer are at the left, with the terminals, switch, power factor and gain controls on the right. Note the shield on the gain control and shielded lead from the mains switch.

New look for ELECTRONICS Aust.

Coincident with the change to a 4-colour cover in March, 1961, we introduced the 6-sided panels which, ever since, have carried our title, price and contents. The panels were deliberately retained, when our name was changed to "ELECTRONICS Australia," to aid in identifying the magazine on the news stands. Now that the new name is known and accepted, the need for the rather dated panels no longer exists. Your next issue of "ELECTRONICS Australia" will come to you with the new cover design, illustrated above but, of course, printed in four colours. Don't miss out. Order now!



ELECTRONICS
Australia
June, 1966

PLASMA FURNACE — See page 1

25c Electronics on atomic subs • Transistor Oscillators

The usual precautions should be observed as regards overheating the components during soldering. This applies particularly to the transistors, diodes and standard resistors and capacitors.

The front part of the meter case consists of a clear plastic moulding. Use has been made of this in that we have provided a pilot lamp just below the meter. This light performs the dual function of illuminating the meter scale and as a "power on" indicator. A bracket to take the pilot lamp socket takes the form of an "L" and it is fixed under the ratio potentiometer.

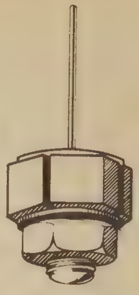
It was found that when the 100pF standard was switched into the bridge circuit and without any capacitor connected to the unknown terminals, there was quite a large residual capacitance reading on the lower end of the ratio scale. The extent of this effect, attributable to the mains lead to the switch on the gain control has been successfully elminated.

This was done by using twin shielded cable between the terminating tag strip in the box and the switch on the gain control. In addition, a piece of tin plate about 1¼in high was formed into about three-quarters of a circle and of such diameter as to be a push fit over the metal body of the gain control. The shield is connected to the earth connection on the gain control. The braid on the twin shielded lead is soldered to the tin plate shield, as well as the earth connection on the terminating tag strip.

Having completed the wiring, the job of calibration must be undertaken before the instrument is ready for use. What is used for the calibration will no doubt depend on what is available. A high grade type of resistor decade box would be very useful. However, this is not essential and assuming that a scale has been etched on the front panel or a separate scale has been carefully fitted, then this scale can simplify the process

Low cost rectifiers for all medium-current Industrial applications

PRESS FIT



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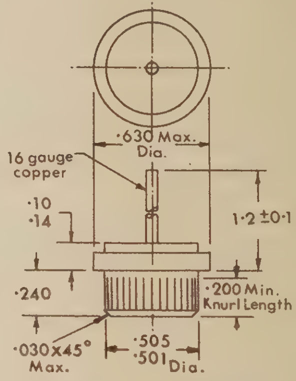
The suffix "R" after type number denotes anode connected to case.



OUTLINE DIMENSIONS IN INCHES

MAXIMUM RATINGS	IN3659 IN3659R	IN3660 IN3660R	IN3661 IN3661R	IN3491 IN3491R	IN3492 IN3492R	IN3493 IN3493R	UNIT
Peak inverse voltage	50	100	200	50	100	200	Volts
Sine wave R.M.S. supply voltage (Resistive load only)	35	70	140	35	70	140	Volts
Sine wave R.M.S. supply voltage (Capacitive or battery load.)	17	35	70	17.5	35	70	Volts
Average half wave rectified forward current. @ 100°C case	30	30	30	25	25	25	Amps
@ 150°C case	25	25	25	18	18	18	
Recurrent peak forward current (50 cps and 25°C case)	100	100	100	75	75	75	Amps
Peak one cycle surge current (50 cps and 150°C case temp.)	400	400	400	300	300	300	Amps
Forword voltage drop @ 25 Amp. D.C., Forword current	1.2	1.2	1.2	1.2	1.2	1.2	Volts
Average full cycle reverse current at rated P.I.V. and I.F. (Resistive load, 150°C case.)	5.0	4.5	4.0	10	10	8	mA
Thermal resistance junction to case	1.0° C/WATT TYPICAL						
Operating junction temperature.	+175° C						

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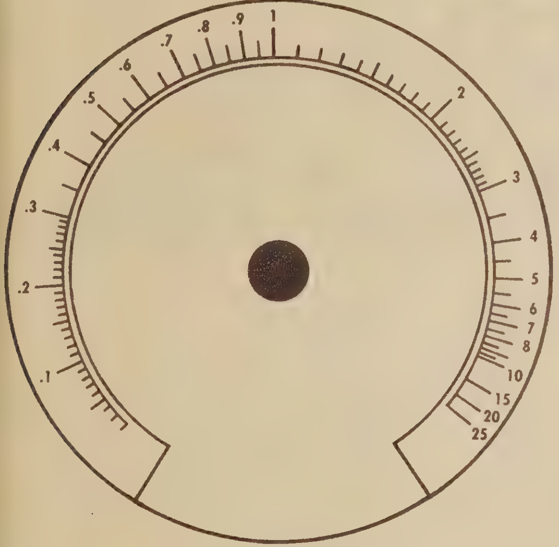
considerably. It should only be necessary to check and adjust the extreme ends of the scale.

If a decade resistor box is not available, we suggest that you purchase three low tolerance resistors of 10, 100 and 1,000 ohms.

Begin the calibration procedure by first setting the knob with its pointer on the potentiometer spindle, such that the pointer over travels each end of the scale by an equal amount. Then as a further preliminary, set the two 100-ohm slider resistors to about the mid positions.

Select the 100 ohm standard on the switch and place the 1,000 ohm resistor across the unknown terminals. Adjust the pointer for a null reading on the meter and corresponding to the clockwise end of the scale. It may be necessary to reduce the gain control but the more gain that can be used, the sharper will be the null and so a more accurate adjustment. If the null position does not correspond precisely with the "10" calibration on the scale, the 100 ohm slide resistor should be adjusted to bring this point right.



As mentioned in the text, full-size printed scales are available for 20c each.

Now replace the 1,000 ohm resistor across the unknown terminals with the 10 ohm resistor. Adjust for a null at the other end of the scale. If the null does not correspond with the "0.1" calibration of the scale, then the 100 ohm slide resistor at this end of the potentiometer should be adjusted in a similar manner to the other one.

It will be necessary to re-check the other end of the scale. More than likely, it will have shifted slightly and will have to be brought into line. Both ends must be checked, back and forth, rather like the alignment of a superhet radio receiver, until both ends are correct.

The centre of the scale should be given a check at this stage. Place the 100 ohm resistor across the unknown terminals and adjust for a null. This should line up on the correct position automatically, assuming that the resistors used as a check are all very close to the correct values and the potentiometer is perfectly linear.

If sufficient error is noted and it is considered that it could be improved, then the pointer may be moved on the potentiometer spindle to correct matters in the centre of the scale. Then the other two resistors will have to be used again to re-set the extreme ends of the scale. This is only a suggestion under these particular circumstances, as it may or may not improve matters. We did not have this problem and it is more than likely that readers will not have any problem here either.

Thus far, we have only calibrated one range of the instrument. However, all other ranges should automatically be correct, within the tolerance limits of the standard resistors and capacitors that have been used. A limited cross check may be made with the 10, 100 and 1,000 ohm resistors used for the initial calibration. By selecting adjacent standard resistors, a further check could be made at least on one end of the scale of the adjacent ranges.

The power transformer and terminating tag strip are in the bottom of the box.

Similar checks could be made on the capacitance ranges, but as we have already mentioned, low tolerance capacitors are not so easy to come by. However, for all practical purposes, capacitance measurements should be quite accurate enough just with the capacitor standards as fitted.

One exception to this could be a further check on the 100pF range. Firstly, check what the residual error is on the low end of the scale and without anything across the unknown terminals. With the method of wiring which we have used, the stray capacitance is fairly low and an expected reading would be about 5pF. This is something we have to live with and small values of capacitance can still be measured, provided the residual reading is subtracted from indicated values.

By way of an example, suppose that an unknown capacitor is measured and the null occurs at a scale reading of 8pF. Subtract the residual of 5pF (or whatever it may be) from this and in this particular case, the actual capacitance is 3pF.

This error should be taken into account in this way up to at least 100pF and even a little higher if desired.

Having ascertained this error, if a capacitor around 100pF of known value is available, then the 100pF standard in the instrument may be checked. Suppose that the checking capacitor is known to be 97pF. Then if the standard is correct, the 97pF unit should be read off the scale as 97+5, which is 102pF. Should the 97pF unit be checked off the scale as say, 107pF, then the standard is about 5pF low and may be padded up to 100pF by shunting it with a good quality capacitor until correct reading is obtained.

The power factor control will not require checking provided the minimum position is set at zero. When measuring capacitance on the two higher ranges, set the ratio control poteniomeer to null. Check and if necessary, adjust the power factor control to give a deeper null. Having done this, it may be necessary to adjust slightly the ratio potentiometer.

Modern plastic and paper capacitors have such a low power factor as a general rule, that the maximum null may be obtained with the power factor control set at zero.

Having built this little bridge unit and made use of it for a while, one may well wonder how he managed without it in the past.

ACOS CHANGER DUST BUG

Essential to all who value their records, the Changer Dust Bug clips easily over most changer arms and sweeps the record both before and behind the stylus, at the same time depositing a very fine antistatic film which prevents dust attraction through static changes. Record and styli life can be increased by up to five times with a Changer Dust Bug. Spare fluid, bristles and plush pad are available in complete spares kit.

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Change in symbols

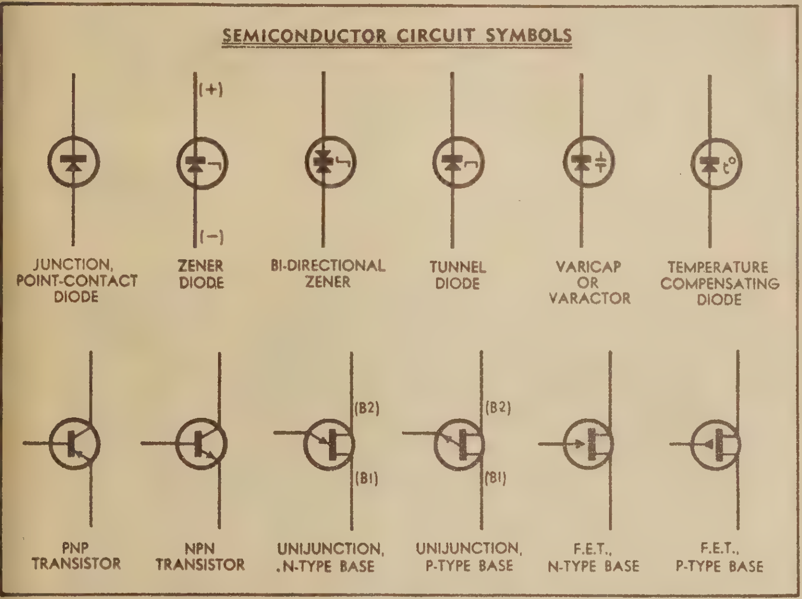
In future, "ELECTRONICS Australia" circuit diagrams will use semiconductor device symbols which conform closely to the symbols now used by a majority of journals and manufacturers.

In some cases the symbols to be used in future differ from those which we have used in recent years. As this could conceivably cause some readers confusion we publish below a diagram showing the most common of the symbols now regarded as standard.

A few words of explanation may be in order regarding this change in symbolism. The symbols which we have used for semi-conductor devices in recent years were adopted in 1962, a time when there was considerable diversity in the systems of symbolism in use by journals and manufacturers.

It is true that in 1962 there were today as it was in 1962. However, as one of our readers has recently observed, quite accurately, we "backed the wrong horse."

While still by no means in universal use, the symbols which were officially standard in 1962 are now being used by a majority of journals and manufacturers throughout the electronics world. This being the case, we have decided that it would hardly be in the interests of our readers to let the situation develop to the point where we might well find ourselves "the only member of the regiment in step." Hence the decision to change, and at this time.



Shown here are the symbols for the devices most often used in our projects. The diode symbols are the same as before apart from the use of different representation for special characteristics. Note that where necessary, any symbol may appear in circuits in mirror-image form, or rotated through 90 degrees.

published both American and British fficial standards for semi-conductors and associated devices, and that these tandards were in many respects quite imilar. However, although the standards were official they were not in widepread use, many journals and manuacturers having established "standards" f their own.

In view of this situation we carried ut a small investigation into the logic, ersatility and drawing ease—or otherise—associated with the various symbol ystems then in use. The conclusions hich we reached led us to adopt a ystem which seemed logical, versatile nd relatively easy to draw and which as apparently gaining ground in Britain nd Europe.

To the best of our knowledge, our hoice of this symbol system is as valid

The symbols which we will use in future will in most cases be those in the American and British standards. This will almost invariably be the case where these two standards agree; however where they do not agree, or where neither corresponds to actual majority usage, we may conceivably use symbols which belong to neither standard, at least until a clear majority preference is established.

In short, while we will endeavour to keep reader confusion to an absolute minimum by maintaining a fairly stable symbolism, it is clear that we shall have to periodically review the situation to keep pace with the ever-expanding number of devices and with the increasingly frequent changes in "standard" practice. (J.R.) ▬

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You'll deal better with
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Cabinets for equipment and speakers at FACTORY PRICES are available from stock or we'll make to your order.
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Trio STEREO AMPLIFIER. 20 watt R.M.S. $110. Linmark stereo amplifier 8 watts and two 8 W.R. speakers $56.00. Also available Pion-eer SMB161, SM83, SMQ300, Star SA30, Roland.

NEW D.P. SLIMLINE enclosure to suit 10in and 12in speakers, 26 x 18 x 7½ $18.50
Cabinet Kit only $10.50

MAGNAVOX or ROLA design slimline cabinet with 8 WR (VC 15, 8 or 3 ohms) or 8 CMX speaker fitted $25.25
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GOODMANS design 3 CF cabinet with tunnel, and Twin-axiom 10 speaker, ¾in material. $54
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WHARFEDALE design 3 CF cabinet (R3) and Golden 10 speaker, ¾in material $62.00
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Available in Maple, Walnut or Rosewood colours. Teak veneer. 10/ extra except last two which are 30/ extra.

PLAYMASTER Bookshelf Speaker System, Complete, $30.
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All other parts including speakers, inner bond, etc., $15.50.
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Designed to accommodate an 8in loud speaker, incorporating a novel Bass Reflex system. Finished in teak with black and gold trim over speakers.

Dimensions: 16in. front width, 11¼in deep, 22in high.

Speakers extra.

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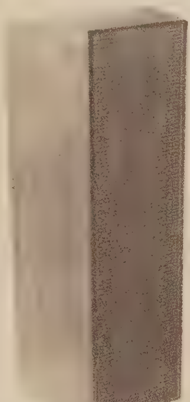
SOUND COLUMNS



Provision for, two 7 x 5 speakers. These totally enclosed, maple finished, attractive sound columns measure 23½in high, 6½in deep and 7in wide across the front.

Speakers extra.

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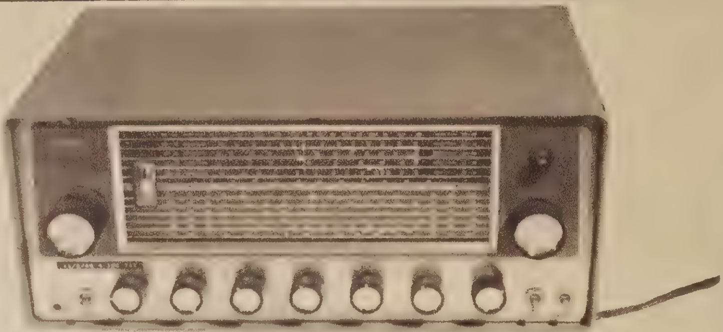


TRIO JR-60 COMMUNICATIONS RECEIVER (WITH 2M CONVERTER)

FREQUENCY COVERAGE: Band 1: 540-1605 Kc. Band 2: 1.6-4.8 Mc. Band 3: 4.8-14.5 Mc. Band 4: 10.5-30 Mc. Band 5: 142-148 Mc.

BANDSPREAD (ham band directly read): 80 meter band. 40 meter band. 20 meter band. 15 meter band. 10 meter band.

SENSITIVITY: 1 microvolt for 10 db signal-to-noise ratio.

SELECTIVITY: Normal: Plus 10 Kc at -75 db plus 1.25 Kc at -6 db. With Q-Multi: Variable to plus 700 cps at -6 db.

OPERATION: AM, SSB, CW, and FM, AM diode detector SSB/CW product detector FM gated beam detector.

POWER SOURCE: 220 volts 50/60 cycles AC.

POWER CONSUMPTION: 75 VA.

AUDIO OUTPUT: 1.5 watt, 8 or 500 ohms impedance.

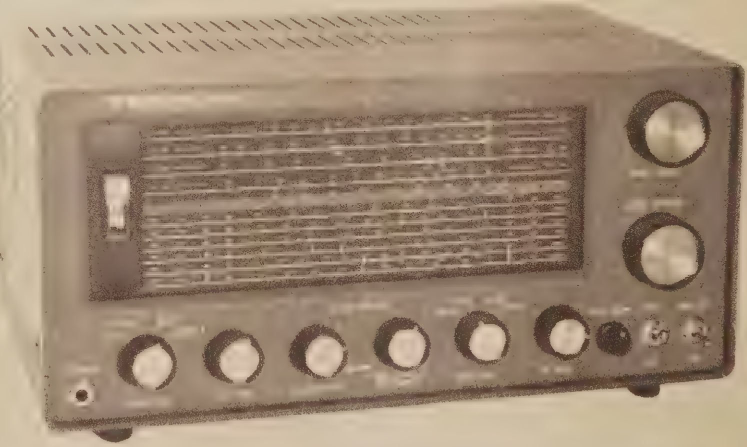
AUXILIARY CIRCUITS: Electrical bandspread Q-Multiplier, ANL, AVC-MVC, BFO 100 Kc crystal calibrator.

TUBE COMPLEMENT: V1-6AQ8 2 meter RF amp. V2-6AU6 2 meter mixer. V3-6BA6 RF amp. V4-6BE6 mixer. V5-6AQ8 HF osc. V6-6AQ8 Q-multi, 100 Kc calibrator. V7-6BA6 1st IF amp. V8-6BA6 2nd IF amp. V9-6AL5 AM detector, ANL. V10-6BE6 Product detector/FM detector. V11-6AQ8 1st AF amp, BFC, V12-6AQ5 AF output. V13-OA2 Voltage regulator. V14-6CA4 Full-wave rectifier. V15-6AQ8 2 meter OSC.

DIMENSIONS: 17in wide, 7½in high, 10in deep.

NET WEIGHT: 23.5lbs.

$191.25



TRIO 9R—59 COMMUNICATIONS RECEIVER

FREQUENCY RANGE: 540-1605 K c/s, 1.6-4.8 M c/s, 4.8-14.5 M c/s, 10.5-30 M c/s.

BANDSPREAD: 3.5 M c/s, 7 M c/s, 14 M c/s, 21 M c/s, 28 M c/s.

SENSITIVITY: 10 UC (input at 10 M c/s). S/N ratio equals 20 db.

SELECTIVITY: Variable from —93 db to 60 db (Q-MULT in operation with plus or minus 10 KC detuning).

OUTPUT: 1.5 Watt.

POWER: 240 AC, 50 VA.

TUBE COMPLEMENT: 6BA6, RF AMP; 6BE6, MIXER; 6BE6, LOCAL OSC.; 2X6BA6, IF AMP; 6AV6, 2ND DET, AF AMP and ANL; 6AV6, Q'MULTIPLIER, BFO; 6AQ5, POWER OUTPUT; 5Y3, POWER RECTIFIER.

SPEAKER IMPEDENCE: 4 or 8 Ohms (Speaker not provided).

DIMENSIONS: Width 15 inches x height 7 inches x depth 10 inches.

WEIGHT: 20.5lbs.

AUX. CIRCUITS: Bandspread; Q-Multiplier; Automatic Noise Control.
AVC-MVC.
Phone Jack Plug.

$119.00

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BRANCHES THROUGHOUT VICTORIA AND RIVERINA

A BATTERY CHARGER

— FOR YOUR CAR

Here is a project for a handy item in any garage — a battery charger designed to "trickle" charge 6V or 12V batteries at around half an amp. It is simple to construct, small enough to be easily handled and accommodated, and quite conservatively rated.

The simple version of the charger, housed in the home made box described in the text.

By Michael Meechan and Philip Watson

Already behind the normal morning schedule, you hurry out to the garage, only to discover that the car won't start —flat battery! The inconvenience of being caught in this, or similar, frustrating situations is obvious, and many car owners will be familiar with the circumstances. With Winter coming on, the days getting shorter, and more inclement weather, the possibility of being caught is greatly increased, as lights, windscreen wipers, and heater fan are used more frequently and for longer periods.

To make matters worse, modern cars are more dependent than ever on their battery. Few have crank handles or, indeed, could be cranked by the average person even if they did. To be sure, they can often be rolled if you are lucky enough to have a driveway that faces downhill, but even this last resort may be denied those who are fortunate (or unfortunate) enough to own a car with automatic transmission. Many of these cannot be roll started and, in fact, can be started in only one way—with the battery.

Normally, the car's generator should keep the battery charged and the wise motorist will see to it that the generating system is functioning correctly. Even so, a combination of short runs, and heavy use of accessories can overtax the best system. Also, there is the occasional accident whereby the parking lights, radio, or heater fan are left on overnight.

Of course, if the battery is worn out, and not merely flat because of abnormal conditions, then charging will only put a crutch under if for a few more miles. In these circumstances, the only thing to do is to replace it.

Apart from the inconvenience of a flat battery, the life of any battery will be seriously shortened if it is existing in a more or less permanent state of partial discharge. Sulphate which forms in the discharge process will eventually harden to the point where it can no longer react chemically during charging. As a result, this much of the battery's capacity is destroyed.

All these points add up to a very good case for a charger permanently installed in the car or garage. Such a charger need only be the simplest type, having a low charging current in the order of 0.5 amp which, when connected to the battery after arriving home in the evening, is sufficient to make good, overnight, most of the losses already discussed. This charging rate is also ideal for "floating," or trickle charging, a battery so that a full charge is maintained even where a vehicle may be garaged for long periods.

It is some years since we last described a charger along these lines, and the submission to our laboratory of a current production Ferguson type PF537 battery charger transformer, as used in our original trickle charger (June, 1952) prompted us to investigate the possibility of producing a new unit, using either this, or a similar transformer.

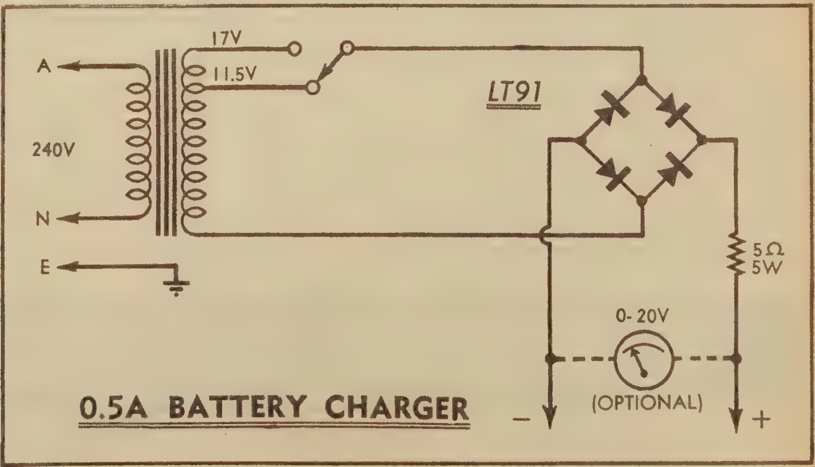
Having made this decision, we next had to consider the types of rectifiers available. In our previous design we used a pair of disposals rectifiers, in parallel, with the suggestion that more of these could be similarly connected, if desired, to increase the charge rate.

This approach is still valid, assuming ready availability of these rectifiers in individual cases, but we felt that readers would like to know that a regular stock item was available as an alternative.

Silicon rectifiers were also considered, but we quickly abandoned that idea. Silicon rectifiers are wonderfully efficient devices, and readily available, but they have a very poor tolerance to short-term overloads. A fleeting short circuit, as might occur when removing leads from a battery, can easily destroy them. Unless elaborate precautions are taken to limit the maximum current flow, they are a poor proposition compared with the copper oxide or selenium types.

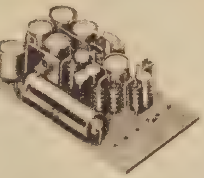
About this time we received a sample Westinghouse LT91 selenium bridge rectifier, rated at 1.5 amps and an input of 18 volts RMS. This seemed ideal for the job. It more than meets the electrical specifications, is physically quite small—1½in x 1⅛in x ⅜in—and is reasonably priced. It is a "contact cooled" type, meaning that it is normally used with a small heat sink to dissipate the heat produced. An area of about 8 square inches is sufficient.

Electrically, the charger is extremely simple. The only major components, apart from the transformer and rectifier, are a series limiting resistor and a two-position switch to select the 6V or 12V connections.



The circuit is quite conventional. The series resistor may be varied to adjust the charging rate, as discussed in the test. The meter is optional.

Tested, off-the-shelf amplifiers for any application



Newmarket pre-assembled Packaged Circuit Amplifiers have been developed to provide standardised starting points in the design of all types of equipment in which amplifiers fulfil a major role. Six are at present available from stock and others are in course of development. Their use saves expensive, time-consuming research, thus cheapening the production of new types of electronic equipment.

Recently released is the PC9 impedance matching A.F. pre-amplifier. It has been specifically designed to enable a high impedance capacitive source to be fed into the relatively low impedance amplifiers PC2, PC3, PC5 and PC7+. An abridged specification is listed below.

SUPPLY VOLTAGE: 9V.
INPUT IMPEDANCE: Typically 600 ohms.
FREQUENCY RESPONSE: Flat from 20 cps to 20 kc/s (± 3db) at 1 kc/s level.
SIZE: 1.4" x 1.25" x .5". WEIGHT: 7 grams. **Price: $6.50**

SPECIFICATION DETAILS

A typical miniature Audio-Amplifier is illustrated actual size above. Circuits are of transformerless, complementary symmetry type, operating off Standard Voltages. Can be wire-in or plug-in as required.

PERFORMANCE DATA	PC1	PC2	PC3	PC4	PC5+	PC7+
Power Output (RMS)	150mW	400mW	400mW	400mW	3W	0.8W
Input Sensitivity (Full output)	100mV	2mV	10mV	200mV	5mV	5mV
Input Impedance (Typical)	1.5K	1K	2.5K	220K	1.5K	1.5K
Load Resistance (Ohms)	40	15	15	15	3	8
Supply Voltage (Nominal)	9V	9V	9V	9V	12V	9V
Total Distortion (Full output)	6%	6%	6%	6%	3%	3%
Frequency Response	330 c/s —15Kc/s	200 c/s —12Kc/s	200 c/s —12Kc/s	200 c/s —12Kc/s	50 c/s —15Kc/s	50 c/s —15Kc/s
Overall Dimensions (Inches) All ¾in. high.	2 x 1	2½ x 1½	2½ x 1½	2½ x 1½	5½ x 1¾	3 x 1¾
PRICE	**$6.25**	**$7.50**	**$7.50**	**$7.50**	**$16.00**	**$9.50**

MODEL No. PC 1
Stethoscope Amplifier.
General Purpose Audio Amplifiers and Drivers.
Intercomm Amplifier.
Telephone Amplifiers.
Laboratory Instrument Amplifiers.
Back Projector Audio Amplifiers.
Loudspeaker Amplifier.
Hospital Board Control Units Intercomm Amplifiers.

MODEL No. PC 2
Modulator Driver Stage.
Intercomm.
Church Hearing Aid Amplifier.
Office Dictating Machines.
Door-Caller Monitor Amplifier.
Inter-Office Communication Amplifier.
Tape Replay Amplifier.
General Purpose Audio Amplifiers and Drivers.
Telemetry Audio Amplifier.
Radio Receiver Audio Amplifier.
Telephone Amplifiers.
Educational Equipment Audio Amplifiers.
Laboratory Instrument Amplifiers.
Language Laboratory Amplifiers.
Tape Recording Amplifiers.
TV Aerial Riggers intercomm Amplifier.
Loudspeaker Amplifier.
Radio Concentrator.
Mine Communication Amplifier.

MODEL No. PC 3
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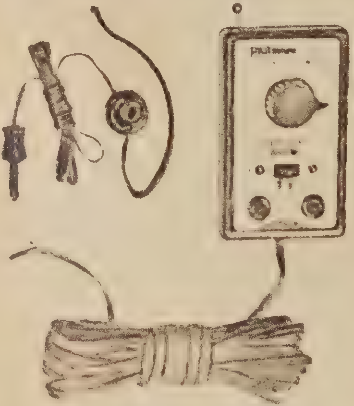

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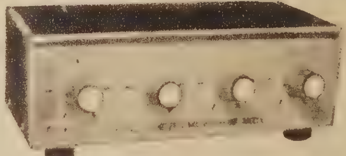

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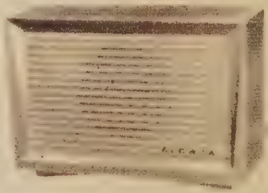

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We used a simple slide switch, similar to ones we have used on a number of previous projects. However almost any single-pole, two-position type, such as a toggle or rotary, would be equally suitable. The only point to watch is that it can be accommodated in the chosen box.

The resistor is shown as 5 ohms 5W but the value is not particularly critical. This resistor serves two functions: to limit the normal charging current to a value which will suit the transformer, and to limit the amount of current through the rectifier in the event of an overload.

The latter might be caused by a short circuit when leads are removed from the battery, by connection to a battery which is in an abnormal state of discharge, by use of the 12-volt position to charge a six-volt battery, or by reverse connection to the battery. We cannot guarantee that the charger will withstand all these forms of abuse all of the time but we have proved that it will cope with most of them most of the time!

The normal charging current should be about 0.5A and the resistor selected should provide about this value.

In this regard, some mention should be made of the transformer ratings. This model is nominally rated at 0.4A but, in the words of one staff member, "it is the coolest 0.4A we have struck for a long time." In fact, it will normally charge at between 0.5 and 0.6A — depending on the battery's condition — for any length of time without becoming more than lukewarm. Considering the temperature at which most modern transformers can work — safely — it would appear that this one is rated quite conservatively.

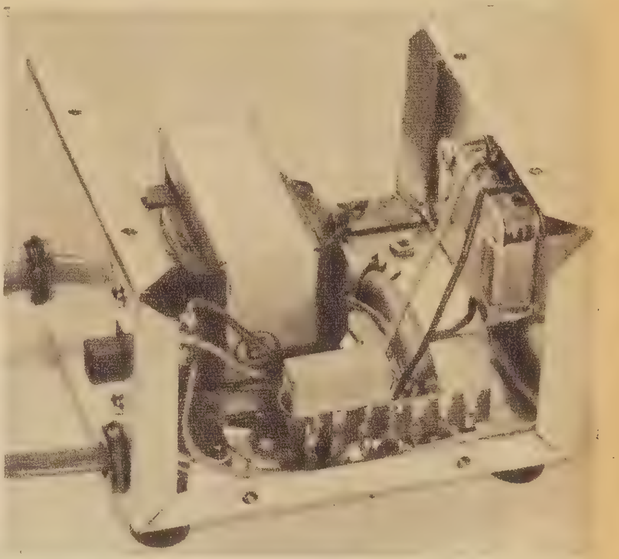
This is further supported by a completely unintentional test we made on this charger. Quite by accident, the unit was switched to the 12-volt position when connected to a six-volt battery. The latter was a spare car battery, rather long in the tooth, which had lain idle and uncharged for some two months or more. In all the circumstances it represented a moderately severe load.

The charger was left running at the higher setting for about three hours at the end of which time the transformer was certainly hot, though by no means "stinking hot," and certainly no hotter than many contemporary designs running at normal ratings. So it would seem safe enough to adopt such a procedure if the circumstances warranted a faster charge rate, which incidentally, was around the 1A mark.

Conversely, if the switch is set to six volts, and the charger connected to a 12-volt battery, it will still provide a charge of around 0.3A. Such a value is often useful when it is desired to simply ensure that a battery is kept "topped up" during periods of idleness.

All things considered, therefore, we can say that the charger has proved itself a versatile and near foolproof unit. We have not made any tests to see how it will behave on prolonged short circuit, or when connected in reverse, and we have no intention of so doing.

We suggest readers adopt a similar policy!



Inside the case. Layout is not critical, but the rectifier must be mounted against the metal case to ensure adequate cooling.

This covers most of the electrical details, leaving only the physical form to be decided. In fact, this isn't at all critical, except that a metal case is more or less mandatory in order to satisfy the heat sink requirements of the rectifier. We actually made two versions; a simple one which will probably appeal to most people and a "De-Luxe" version incorporating a voltmeter as a means of indicating the battery's condition.

This latter was built by a staff member, who had a personal need for such a unit. Use of a voltmeter to monitor a battery's condition was discussed at considerable length in the August, 1965, edition and those interested would be well advised to study it in detail. However, we are reproducing a table from it showing typical voltages to be expected in a car electrical system.

In the simpler form, we housed the unit in a small home-made metal box, and a good idea of the general form

This table, taken from the August 1965 issue, gives typical voltages for various battery conditions. The "Motor Stopped or Idling" column applies particularly to this article.

METER READING 6-volt system	 12-volt system	MOTOR STOPPED OR IDLING	MOTOR TURNING OVER ON STARTER	MOTOR NORMAL RUNNING (At least twice idling speed)
Below 4.5 volts	Below 9.0 volts	Battery "flat." Meter leads or fuse open circuited. Meter reverse connected.	Meter defective, disconnected or improperly wired. If the engine will start and/or run, the battery voltage could scarcely be this low.	
4.5 to 5.9 volts	9.0 to 11.8 volts	Battery undercharged or extremely cold. Motor will turn sluggishly and might not start.	Normal range for winter to summer starting.	Generator not charging or voltage regulator faulty. Alternatively, current drain of vehicle's electrical equipment (lights, radio, etc.) exceeds generator output.
5.9 to 6.4 volts	11.8 to 12.8 volts	Battery charged. Varies with temperature, type of battery and degree of charge.	Meter defective. Voltage could not be this high, if starter is actually turning motor over.	Battery fully charged but generator not working or voltage regulator set too low.
6.4 to 7.5 volts	12.8 to 15.0 volts	This high reading is normal for a short period after driving, due to battery "surface charge." If motor has been stopped for some time, however, the meter is defective and reading high.	As above.	Normal range for properly functioning generator and regulator. Exact reading varies with battery charge, engine speed, temperature and regulator setting.
Above 7.5 volts	Above 15.0 volts	Reading too high for surface charge. Meter is probably defective.	As above.	Voltage regulator set too high or contacts sticking. Battery fluid level excessively low.

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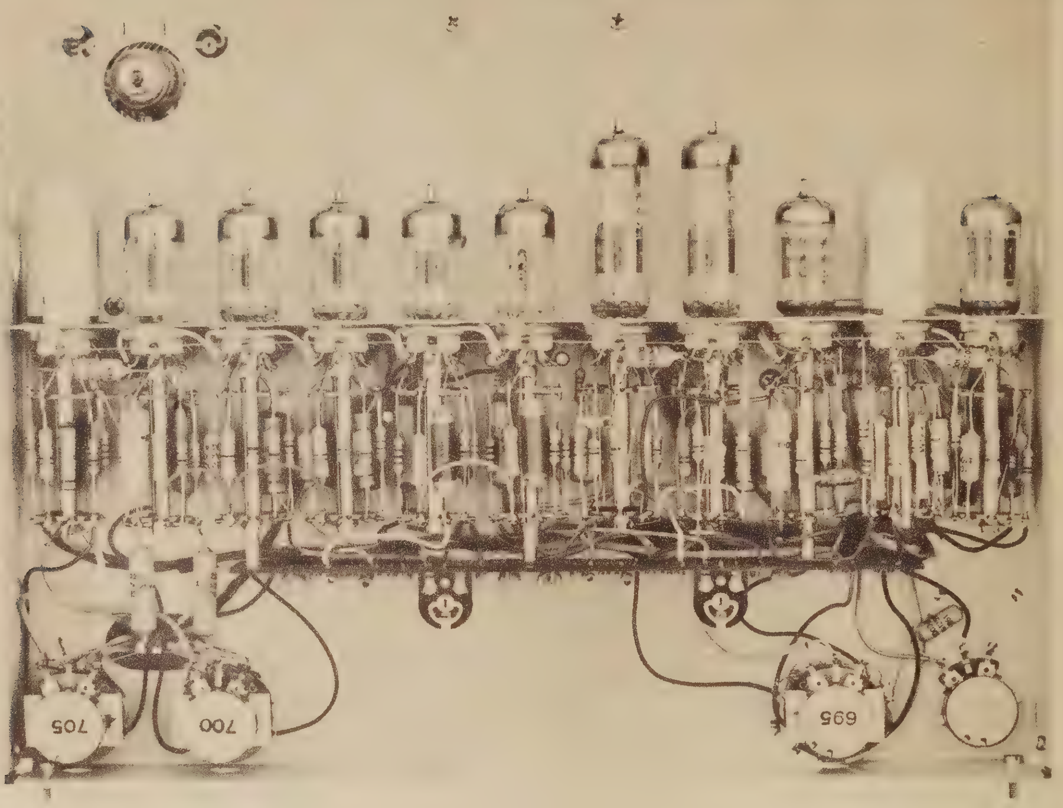

Amplifier wiring

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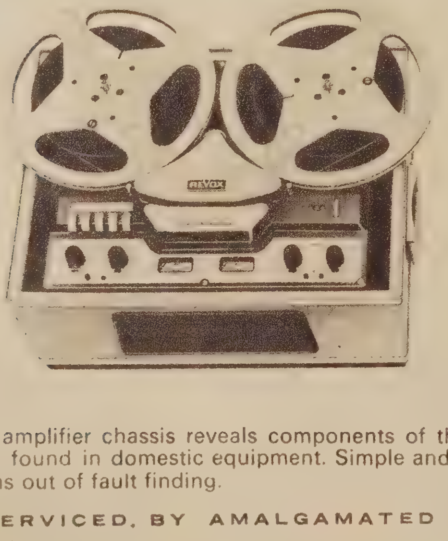

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can be obtained from the photographs. The main part of the box, holding the components, was made from a scrap of tinplate bent up in the workshop vyce. The cover is from aluminium, bent into a "U" shape to form sides and top.

To facilitate mounting the cover, we soldered ⅛in Whit. brass nuts to the inside of the tinplate flanges. If aluminium is used throughout this cannot be done, but small self-tapping screws would probably do as good a job. However, take care that their extra length does not cause any short-circuits.

For those who do not wish to make a box, there are a number of small ready-made boxes available, and we found one very similar to our own design among a batch of odd samples we had collected over the years. Although a little smaller it would have been quite large enough. Unfortunately, we are no longer sure who made it.

The "De-Luxe" version was built in another sample box, this time from Electronic Developments in Melbourne. It was sent to us some considerable time ago and we are not sure whether it still is a standard line. However, something similar should be available. It measures 6in x 3¼in x 2⅝in.

Apart from the additional meter circuit this unit is the same as the previous one. The meter is an ex-disposals unit of a type too well known to need much comment. They are normally 5mA movements with an inbuilt multiplier making a 20-volt unit. Almost any combination of movement and multiplier capable of producing a full-scale deflection of 15 or 20 volts would be suitable.

Although, theoretically, the meter should be connected directly to the battery terminals, to avoid loss resistance in the cables, the amount of current involved in this case is low enough for this not to be a problem. It is a good deal easier, therefore, to simply connect the meter directly to the appropriate points inside the charger.

Little need be said about the wiring, except to emphasise that care should be taken to see that both the low voltage and high voltage (mains) leads are securely terminated inside the case. If not, there is a very real risk that these could be jerked free in use, resulting in a "live" case if the mains should be involved, or a short-circuited battery, with attendant smoke, fire and confusion, if it should involve the battery leads!

Two simple clamps, made from scrap aluminium, were used in the original, and are visible in the photograph.

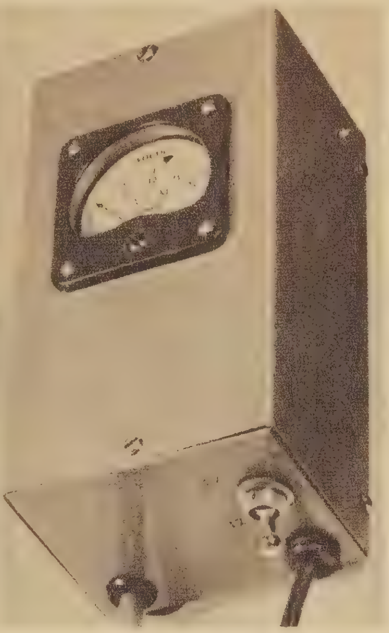
As a further precaution, a three-core cable should be used for the mains connection, with the earth wire correctly terminated at the chassis and the three-pin plug. Don't be tempted to use a light socket in an environment such as a garage with a concrete floor.

PARTS LIST

- *1 Case 4in x 4in x 2½in (see text).*
- *1 Ferguson PF537 transformer, or similar.*
- *1 Westinghouse LT91 rectifier, or similar.*
- *1 5-ohm 5-watt wire-wound resistor.*
- *1 two-position slide switch.*
- *1 7-lug miniature tag strip.*
- *Length of 3-core mains cable and plug, 2-core cable for charging leads, 2 battery charging clips, 4 rubber feet, 2 grommets, nuts, bolts and washers, straps for mains and charging leads, solder, hook-up wire.*

Both sides of the low voltage circuit should be kept free of the chassis, in order that there will be no risk of shorts between the charger box and the car body, regardless of the chassis polarity of the car.

Finally, what housing and/or connection arrangements should be made for the charger? This may seem a small point, but it must be appreciated that the secret of using a small charger like this to maximum advantage is to use it regularly and consistently. And, if this is to be done, it is essential that the job of connecting the charger to the car be made as easy as possible. Otherwise there will be a strong temptation to "duck shove it" once the novelty of the arrangement has worn off.



The "De-luxe" version built in a commercial case and fitted with a meter for battery supervision.

Equally important is the requirement that it should be capable of being disconnected quickly and simply—and by all members of the household. The womenfolk, in particular, are not likely to tolerate an arrangement which requires that they have to close the bonnet, or reach into an awkward position behind the dash, every time they wish to use the car.

Finally, it is important that the presence of the charger in operation should not prevent the car being locked. Few people like the idea of leaving a car unlocked even in a garage, and certainly not in a carport.

The ideal arrangement would seem to be some kind of socket mounted externally on the car, with a matching plug connected to the charger. The job of connecting or disconnecting is then reduced to one of simple plugging or unplugging, and switching the charger on or off.

Finding a place to mount such a socket, which is at the same time easy to reach yet reasonably unobtrusive, may present a minor problem, and individual readers will doubtless have their own ideas on the subject. However, one suggestion is an arrangement similar to that used by caravan owners to connect indicating lights and the van battery to the car—a polarised socket mounted on a small metal plate or bracket fastened behind the rear bumper.

All the foregoing discussion assumes that the charger is to be accommodated outside the car, say, on the garage bench or wall, near a power point. However, it has also been suggested that the charger could be mounted in the car, with its output connected permanently into the electrical system.

This arrangement would appear to be advantageous mainly where the car may be regularly garaged at different places, and where circumstances dictate that the battery may require boosting at all or any one of them.

In general, the same remarks apply as for the previous arrangement but the need to make connection at the 240V level, rather than 6V or 12V level, may present additional problems in some cases. In particular, any external plug should be adequately protected from the weather and from physical damage, to ensure that it never becomes a hazard. ■

ERRATA

"BREADBOARD" HOOK-UPS
MARCH, 1966.

Parts list, page 72. The OC41 transistor quoted is a misprint and should read OC71 as per the circuit diagram and Veroboard drawing.

Circuit diagram, page 75. The electrolytic capacitor in parallel with the 1.5K resistor is 50uF. Both electrolytics should be 3VW, as given in parts list and Veroboard drawing.

Circuit diagram page 77. Battery terminals marked with the incorrect polarity. Emitter line should be connected to the positive terminal, and collector line to negative. The Veroboard drawing is correct.

THREE BAND RECEIVER
APRIL, 1966.

Error in pin numbers of coil diagram. Coil L4 in the diagram incorrectly shows bottom end of primary as connected to pin 4; this should read pins 2 and 3. Primary connection shown going to pins 2 and 3; should be altered to read pin 4.

PENDULUM ELECTRIC CLOCK
APRIL 1966. Page 87.

Reference to three-quarter length pendulum "... intended to operate at 80 swings or 40 complete oscillations per second." This should read "... complete oscillations per minute."

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("R. TV & H." March, 1964)

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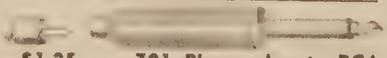

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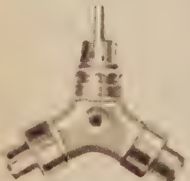

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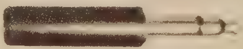

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The Serviceman

WHERE THERE'S SMOKE THERE'S —

"Where there's smoke there's fire," is the version most of us know, particularly as it applies to gossip in a country town. In the more literal sense, and when dealing with electronic devices, it is less accurate because they can generate copious quantities of smoke without the tiniest flame being visible. On the other hand, a recent experience suggests that "Where there's smoke there's panic" might be a more suitable version!

This story started just as I was finishing a routine call to one of my regular customers. I had finished the job and was gathering up my things when the customer's phone rang. The lady of the house answered it and, as she lifted the receiver it gave forth a burst of high-pitched "Donald Duck" talk. Although it was none of my business, I couldn't help registering that, whoever it was, they were certainly excited.

In fact, my customer had some difficulty making sense of the call for a few seconds, and then only after some obvious effort to calm the person at the other end.

When she finally did make sense of it she turned to me quickly.

"It's Mrs Johnson down the road" (another of my regular customers). "She says her TV set's on fire. She saw your truck here and wants to know what to do. She wants to know if she should throw a bucket of water over it."

"Tell her not to do anything until I get there," I called over my shoulder as I sprinted for the truck. I didn't take the bucket of water threat very seriously but, even without it, the set could be seriously damaged unless someone brought things under control quickly. If I was lucky, I might be in time to confine the trouble to one section.

It was only a few hundred yards to the house, and I was there almost as soon as she put the phone down. She met me at the front door and from inside came an unmistakable "tranny-going up" smell that confirmed her story.

"Oh dear, I'm so glad you've come. I didn't know whether to call you or the fire brigade, or whether to throw a bucket of water over it. Then I saw your truck up at Mrs Martin's. Do you think you can put it out?"

Then she paused for breath.

We were in the lounge-room by this time and there was the TV set with evil-smelling smoke wafting from behind the cabinet. And I suddenly realised that the bucket of water was no mere figure of speech. For there, in the centre of the loung-room carpet, was a plastic bucket three parts full of water and on the nearby china cabinet a large saucepan full to the brim.

The lady had really meant business.

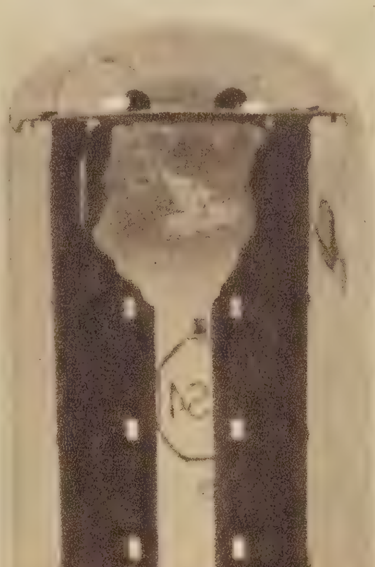
I'm afraid the mental picture this conjured up was so vivid that, for a second or so, I forgot the immediate problem. Then, collecting my thoughts, I started looking for the power point.

"Have you switched it off?" I asked, as I began tracing the cord to a spot behind a lounge chair.

"Oh no," she replied, "I was too frightened I might get a shock or something."

By which time I had found the point and smartly pulled the plug out.

I tried to explain that it was perfectly safe to switch the set off—at the power point — and that this was normally enough to control the situation. I don't know whether I convinced her or not; somehow I have my doubts. Once a woman makes up her mind to be frightened of something—well, it's made up.



A wrecked rectifier. Severity of the overload is indicated by condition of the plates.

Nevertheless, I couldn't help comparing the imaginary danger with the real one. The imaginary danger was that she "might get a shock or something" (I don't know what the "something" was), whereas, in fact, the chances of such a situation are so remote as to be well beyond lottery odds.

On the other hand, she apparently would have no compunction about heaving several gallons of water over the set, and the dangers and disadvantages of such an act could be very real indeed.

In the first place it would be a horribly messy business. Regardless of how the water was thrown most of it would bounce off the cabinet and finish up on the wall and carpet. Repairing the damage thus caused would be a major one in itself.

But, even assuming that some water penetrated the cabinet — possibly by bouncing off the wall and passing through the ventilation slots in the cabinet back — it would do more harm than good. If it reached the power transformer it might even result in a complete breakdown of the primary winding insulation and a "live" chassis.

Also, any that reached hot glass envelopes — valve or picture tube — would almost certainly cause these to crack, while the effect on IF transformers and other windings can be imagined.

Thus, the more effectively the water was introduced into the works — and it is assumed that this is what the thrower would aim to do — the more harm it would do. In an extreme case the set might be so badly damaged as not to be worth repairing.

In the light of all this I find it difficult to understand the reasoning which would prompt such drastic treatment. For, serious though the damage may be when a set is overloaded, it is usually confined to one or two components and the expense of replacing these, while not easily ignored, would be only a fraction of the cost likely to be incurred when one starts heaving buckets of water around in the lounge-room.

So, unless the situation is so bad that there is a very real danger to the house itself, any attempt to control an overloaded set with a bucket of water is about as logical as cutting a person's head off to cure a sore throat

However, to return to the story. I removed the back of the set and was greeted with a cloud of pungent smoke which had accumulated inside. When this cleared it became immediately obvious that the 5AS4 rectifier had "had it." The glass was cracked and displayed the characteristic white deposit inside. It was also very hot, and it took some juggling with a screwdriver blade and cloth to get it out of the socket without inflicting third degree burns on myself!

When I did get it out and took a closer look at it, I must admit I was rather shocked at its condition. As can be seen from the photograph reproduced here, a large section of each plate was missing, presumably melted by the extreme heat of the overload. Lying loose inside the glass were globules of once molten metal and short lengths of wire support rods. In short, it was pretty much of a mess.

Similarly, the power transformer was sizzling hot, which more or less pinpointed the general nature of the fault. What puzzled me, though, was why one of the two fuses had not blown in time to prevent such drastic damage. One fuse, about 1.5A rating, is located in the power transformer primary and the other, a lighter type, in the main HT line.

Examination of the primary fuse told an interesting story. At some stage of the set's life some bright person had replaced the 1.5A fuse with a 10A type and, while the customer denied all knowledge of this, I would have been prepared to lay pretty long odds that it had been "borrowed" from the family car.

Small wonder that the transformer and rectifier were red in the face.

After this, I was rather surprised to discover that the HT fuse was still intact, but this cross-checked with the fact that I could find no shorts anywhere in the HT line. It all added up to the suggestion that the fault had occurred within the 5AS4, probably in the form of a loose particle of cathode material. And, once started, an overload of this kind can be self destructive, the heat causing distortion of the elements, bigger and better short circuits, more heat and, eventually, broken glass.

In fact, I was prompted to ask myself whether the failure of the original 1.5A fuse may not have been caused by the preliminary fault in the 5AS4. Had the cause been investigated then and there, or the correct fuse fitted, it seemed likely that the present crisis might have been avoided.

By the time I had made all these investigations, the transformer had cooled somewhat and, largely on spec, I switched the set on again—with the proper fuse in it this time—without the rectifier.

The filaments came on immediately and, after about five minutes, the transformer was still running normally with no sign of distress. I took the opportunity to go back to my original client and finish off the job there, leaving the still somewhat agitated housewife on guard, with instructions to ring me at the first wisp of smoke.

When I returned about 15 minutes later, the transformer was still running normally, suggesting that, in spite of the caning it had taken, it might have survived.

I plugged in a new 5AS4 and watched it carefully for any sign of fireworks. There were none, but the sound came up almost immediately, followed shortly thereafter by the picture. It was quite a dramatic, albeit unintentional, demonstration of the fact that, in spite of the smoke and general panic, there was really very little wrong with the set. Compared with the possible consequences of the bucket-of-water treatment, the price of a new 5AS4 seemed insignificant indeed.

True, I wasn't 100 per cent happy about the transformer. Even though it was running satisfactorily right now, I couldn't be sure that it had not suffered some damage which would show up later. I advised the customer of this, told her what it would cost to fit a new one, and left her to discuss it with her husband. I also made the point that, provided no one tampered with the fuse, there was little risk of further damage, even if it did fail.

That was several weeks ago and I have heard nothing since, so I assume they have decided to take a chance on it. Which is fair enough and, having gone this long, the chances are that it will last as long as the set.

And that should be many years if the husband can resist the temptation to fit the first fuse that comes handy, and his wife to grab a bucket of water at the first sign of smoke.

Another job I had this month was sufficiently novel to be worthy of comment, mainly by reason of some unusual symptoms it presented.

According to the owner, the set had failed in the middle of a program, exhibiting two obvious symptoms as it did so. (1) There was a loud hissing cum crackling sound from the loudspeaker and (2) the picture blacked out. He very wisely switched it off and called me.

When I checked the set I found exactly the same symptoms, except that the nature of the noise in the speaker immediately suggested interference from an EHT breakdown somewhere in the set.

A glance into the back of the cabinet confirmed that there was, indeed, something unusual going on in the EHT system, although exactly what was not immediately clear. All I could see was a number of small sparks between the aquadag coating on the picture tube and spring brass metal strip which was the chassis contact for this coating.

Apparently, the contact between the coating and the contact was not as good as it might have been, perhaps due to dust or oxidisation of metal surface. However, this in itself should not have been sufficient to cause either the failure of the set or the sparks, since I imagine it was no better or worse than average.

The real question was: Why was the aquadag at such a high potential relative to chassis? Its normal association with the EHT supply is simply as one plate of a capacitor—on the chassis side—used to filter the EHT supply. The other plate is, of course, the final anode of the picture tube, sometimes called the ultor, which is a somewhat similar coating inside the glass.

Short of a breakdown in this capacitor, which was extremely unlikely, I couldn't see how the EHT was appearing on the aquadag.

To get a better idea of the order of voltage on the aquadag, I separated the chassis contact from it with a scrap of insulating material—and produced a fine healthy spark in the process. There seemed little doubt that it was pretty substantial.

At this stage I happened to look at the screen again, and was intrigued to find that a portion of the picture had reappeared. It was only a small portion a couple of inches wide, on the left-hand side of the screen, and appeared to be transposed left to right, suggesting some kind of foldover effect. It was also badly distorted in other respects, the line structure having a distinct curve in it.

While I was watching this, and trying to decide whether it had any real significance, I idly ran my hand along the edge of the cabinet, which was trimmed with a decorative metal beading. As my finger passed over a joint where the metal had a slighlty rough edge, I experienced a slight burning sensation and mild shock. Running a screwdriver blade along the metal strip produced a small but quite distinct spark.

And that, I had to admit, was a new one on me!

Returning to the back of the cabinet, I unhooked the ultor lead and held it near the chassis. It gave forth a healthy spark and, superficially, appeared quite normal. However, something about the nature of the spark made me suspicious, and I checked it again.

This time I was more convinced than ever. Without being able to say exactly why, I felt sure that the spark was more AC than DC and, with this suggestion, all the other symptoms suddenly made sense. What was more, there was only one likely explanation for AC on the ultor lead.

I went straight to the 1B3 EHT rectifier, pulled it out, and replaced it with a new one. As soon as the set warmed up and I tried the ultor lead near the chassis again, I knew I was right. The nature of the spark was altogether different. This was confirmed when I restored the lead to its proper connection and brought up a normal picture.

And, in case my telling of the story gives the impression that it was a difficult and lengthy process, let me hasten to correct this. True, some of the symptoms were unusual, simply by reason of circumstances, but the whole job took only a little over 10 minutes. I have related it in the hope that it may help some less experienced colleague by putting the symptoms in their right perspective.

So, let's analyse what happened and why. The fault was a short between plate and cathode of the 1B3, connecting the ultor directly to the secondary of the EHT transformer.

With AC instead of DC on the ultor, the capacitance between the ultor and the aquadag presented a relatively low impedance, thus allowing the aquadag to assume a potential nearer that of the ultor. This was helped by some resistance between the aquadag and the chassis contact, but which would have been of little significance in the ordinary way.

When this contact was disconnected the effect was almost complete. The only path to chassis was the rather devious one via the picture tube supporting straps and cradle, which were screwed to the cabinet rather than mounted on the chassis, then via the cabinet woodwork to the chassis.

Fairly obviously, some of these paths were not very good ones and, at lower voltages, one normally regards a wooden cabinet as a quite good insulator However, pushed hard enough, even wood will pass some current, particularly if it happens to have absorbed some moisture from the atmosphere.

As far as the voltage which appeared on the beading is concerned, the leakage path involved was quite small. Several of the screws supporting the picture tube harness were driven into the back of the cabinet front and, allowing for their probable length, could have come within an inch or less of the beading. It is easy to understand why it tickled.

Finally, there is the matter of picking the difference between an AC and DC spark. This is to some extent intuitive and not many servicemen can tell you how they know the difference, even

(Continued on page 150)

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PART No.	Package*	V_{CBO} volts	V_{EBO} (volts)	h_{FE} (typ.)	V_{CE} SAT (volts) max.	f_T (typ.) mc
2N709	TO-18	15	4·0	55 @ 10 mA	0·25 @ 10 mA	800 @ 5 mA
2N918	TO-18 4 leaded	30	3·0	50 @ 3·0 mA	0·4 @ 10 mA	900 @ 3 mA
2N2369A	TO-18	40	4·5	66 @ 10 mA	0·2 @ 10 mA	675 @ 10 mA
2N2483	TO-18	60	6·0	80 @ 10µA	0·35 @ 1·0 mA	20 @ 50 µA
2N2484	TO-18	60	6·0	290 @ 10µA	0·35 @ 1·0 mA	20 @ 50 µA
2N3013	TO-52	40	5·0	60 @ 30mA	0·5 @ 300mA	550 @ 30 mA
2N3014	TO-52	40	5·0	60 @ 30 mA	0·18 @ 30 mA	550 @ 30 mA
2N3107	TO-5	100	7·0	190 @ 150 mA	1·0 @ 1A	86 @ 50 mA
2N3108	TO-5	100	7·0	70 @ 150 mA	0·25 @ 150 mA	86 @ 50 mA
2N3109	TO-5	80	7·0	190 @ 150 mA	1·0 @ 1A	86 @ 50 mA
2N3110	TO-5	80	7·0	70 @ 150 mA	0·25 @ 150 mA	86 @ 50 mA
2N3114	TO-5	150	5·0	60 @ 30 mA	1·0 @ 50 mA	54 @ 30 mA
2N3137	TO-5	40	4·0	70 @ 50 mA	0·3 @ 50 mA	750 @ 50 mA
2N3299	TO-5	60	5·0	75 @ 150 mA	0·6 @ 500 mA	400 @ 50 mA
2N3300	TO-5	60	5·0	220 @ 150 mA	0·6 @ 500 mA	400 @ 50 mA
2N3301	TO-18	60	5·0	75 @ 150 mA	0·22 @ 150 mA	400 @ 50 mA
2N3302	TO-18	60	5·0	220 @ 150 mA	0·22 @ 150 mA	400 @ 50 mA
2N3304	TO-18	−6·0	−4·0	63 @ 10 mA	−0·16 @ 10 mA	700 @ 10 mA
2N3502	TO-18	−60	−5·0	250 @ 50 mA	−0·25 @ 50 mA	250 @ 50 mA
2N3503	TO-5	−60	−5·0	150 @ 150 mA	−0·25 @ 50 mA	250 @ 50 mA
2N3504	TO-18	−45	−5·0	150 @ 150 mA	−0·25 @ 50 mA	250 @ 50 mA
2N3505	TO-5	−45	−5·0	150 @ 150 mA	−0·25 @ 50 mA	250 @ 50 mA
2N3962	TO-18	−60	−6·0	210 @ 10 µA	−0·25 @ 10 mA	50 @ 0·5 mA
2N3963	TO-18	−80	−6·0	210 @ 10 µA	−0·25 @ 10 mA	50 @ 0·5 mA
2N3964	TO-18	−45	−6·0	320 @ 10 µA	−0·25 @ 10 mA	60 @ 0·5 mA
2N4030	TO-5	−60	−5·0	80 @ 100 mA	−0·15 @ 150 mA	150 @ 50 mA
2N4032	TO-5	−60	−5·0	160 @ 100 mA	−0·15 @ 150 mA	200 @ 50 mA

*All metal package.

PART No.	Package*	V_{CBO} (volts)	V_{EBO} (volts)	h_{FE} (typ.)	V_{CE} SAT (volts) max.	f_T (typ.) mc
2N4034	TO-18	−40	−5·0	150 @ 10 mA	−0·14 @ 10 mA	550 @ 10 mA
2N4035	TO-18	−40	−5·0	200 @ 10 mA	−0·14 @ 10 mA	600 @ 10 mA
FT7207A	7–16" Hex. isolated case	120	8·0	75 @ 2A	0·6 @ 2A	90 @ 500 mA
FT7207B	7–16" Hex. isolated case	100	8·0	75 @ 2A	0·6 @ 2A	90 @ 500 mA
FT34A	TO-59	150	6·0	85 @ 2A	0·6 @ 10A	100 @ 500 mA
FT34B	TO-59	120	6·0	210 @ 2A	0·6 @ 10A	100 @ 500 mA
FT34C	TO-5	150	6·0	85 @ 2A	1·0 @ 5A	100 @ 500
FT34D	TO-5	120	6·0	216 @ 2A	1·0 @ 5A	100 @ 500
AY6105	TO-72	30	3·0	80 @ 4 mA	3·0 @ 10 mA	500 @ 4 mA

FIELD EFFECT TRANSISTORS

PART No.	Package	Type	BV_{DSS} volts (min)	BV_{GSS} (volts) min.	Y_{fs} (min)	$r_{ds(on)}$ (max)
2N3277	TO-33 Metal	P. Channel Bi-Polar	−25	−25	100 µmhos	—
2N3278	TO-33 Metal	P. Channel Bi-Polar	−25	−25	150 µmhos	—
2N4065	TO-18 4 lead	P. Channel M.O.S.	−30	±25	400 µmhos	1·5 k.OHMS
2N4120	TO-18 4 lead	P. Channel M.O.S.	−30	±25	700 µmhos	1·0 k.OHMS
2N4066	TO-5 6 lead	dual P. Channel M.O.S.	−30	±25	1·5 mmhos	300 OHMS
2N4067	TO-5 6 lead	dual P. Channel M.O.S.	−30	±25	2·5 mmhos	250 OHMS
FI100	TO-18 4 lead	P. Channel M.O.S.	−30	±25	300 µmhos	1·0 k.OHMS
FI0049	TO-5 6 lead	dual P. Channel M.O.S.	−30	±25	400 µmhos	250 OHMS

DIODES

PART No.	Package	B_V	$V_F = 1V$ @	C_O @ OV.	T_{rr}
FD100	DO7	75	10mA	2·0pf	2·0nsec.
FD200	DO7	200	100mA	5·0pf	50nsec.
FD300	DO7	150	200mA	6·0pf	—
FD600	DO7	75	200mA	3·0pf	4nsec.
FD700	DO7	30	50mA	0·75pf	0·7nsec.

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PART No.	Package	V_{CBO} (volts)	V_{EBO} (volts)	h_{FE} (typ.)	V_{CE} SAT (volts) max.	f_T (typ.) mc
2N3563	TO-18 epoxy	30	2·0	50 @ 8 mA	0·1 @ 10m A	900
2N3564	TO-18 epoxy	30	4·0	70 @ 15 mA	0·3 @ 20 mA	750
2N3565	TO-18 epoxy	30	6·0	150–600 @ 1 mA	0·35 @ 1 mA	60
2N3566	TO-5 epoxy	40	5·0	400 @ 10 mA	1·0 @ 100 mA	60
2N3567	TO-5 epoxy	80 V_{CEO} 40	5·0	80 @ 150 mA	0·25 @ 150 mA	80
2N3568	TO-5 epoxy	80 V_{CEO} 60	5·0	80 @ 150 mA	0·25 @ 150 mA	80
2N3569	TO-5 epoxy	80	5·0	150 @ 150 mA	0·25 @ 150 mA	80
2N3638	TO-5 epoxy	–25	–4·0	67 @ 50 mA	–0·25 @ 50 mA	200
2N3638A	TO-5 epoxy	–25	–4·0	110 @ 150 mA	–0·25 @ 50 mA	200
2N3639	TO-18 epoxy	–6	–4·0	63 @ 10 mA	–0·16 @ 10 mA	750
2N3640	TO-18 epoxy	–12	–4·0	63 @ 10 mA	–0·2 @ 10 mA	750
2N3641	TO-5 epoxy	60 V_{CEO} 30	5·0	75 @ 150 mA	0·22 @ 150 mA	400
2N3642	TO-5 epoxy	60 V_{CEO} 45	5·0	75 @ 150 mA	0·22 @ 150 mA	400
2N3643	TO-5 epoxy	60 V_{CEO} 30	5·0	220 @ 150 mA	0·22 @ 150 mA	400
2N3644	TO-5 epoxy	–45	–5·0	150 @ 150 mA	–0·4 @ 150 mA	250
2N3645	TO-5 epoxy	–60	–5·0	150 @ 150 mA	–0·4 @ 150 mA	250
2N3646	TO-18 epoxy	40	5·0	60 @ 30 mA	0·2µ @ 30 mA	550
2N3691	TO-18 epoxy	35	4·0	40–160 @ 10 mA	0·7µ @ 10 mA	300
2N3692	TO-18 epoxy	35	4·0	100–400 @ 10 mA	0·7v @ 10 mA	300
2N3693	TO-18 epoxy	45	4·0	110 @ 10 mA	—	350
2N3694	TO-18 epoxy	45	4·0	200 @ 10 mA	—	350
2N3919	TO-3 metal	120	6·0	85 @ 2 A	1·2 @ 10 A	100
2N3920	TO-3 metal	120	6·0	210 @ 2A	1·2 @ 10 A	100
2N4121	TO-18 epoxy	–40	–5·0	150 @ 10 mA	–0·14 @ 10 mA	550
2N4122	TO-18 epoxy	–40	–5·0	200 @ 10 mA	–0·14 @ 10 mA	600
2N4248	TO-18 epoxy	–40	–5·0	75 @ 100 µA	–0·25 @ 10 mA	50
2N4249	TO-18 epoxy	–60	–5·0	180 @ 100 µA	–0·25 @ 10 mA	50
2N4250	TO-18 epoxy	–40	–5·0	400 @ 100 µA	–0·25 @ 10 mA	50
AY1110	TO-5 epoxy	–25	–4·0	150 @ 10 mA	–0·25 @ 50 mA	190
AY6101	TO-5 metal	45	5·0	75 @ 150 mA	0·22 @ 150 mA	400
AY6102	TO-5 metal	–40	–4·0	60 @ 150 mA	–0·4 @ 150 mA	200
AY6103	TO-18 metal	12	4·0	70 @ 10 mA	0·25 @ 10 mA	800
AY6104	TO-18 metal	–6	–4·0	60 @ 10 mA	–0·2 @ 10 mA	700
AY8105	TO-5 metal	60	5·0	100 @ 300 mA	0·75 @ 1 A	40
AY8106	TO-5 metal	60	5·0	75 @ 300 mA	0·75 @ 1 A	40

DIODES

PART No.	Package	BV	VF	CO @ 0.v.	Trr
AN1104	TO-18 epoxy	100	1·1 @ 100 mA	6·5pf	70nsec.
AN1105	TO-18 epoxy	150	1·1 @ 100 mA	6·5pf	70nsec.
AN6101	DO-7 glass	75	1·1 @ 20 mA	2·5pf	5nsec.
AN6201	DO-7 glass	150	1·15 @ 200 mA	8pf	60nsec.

The products listed on these 3 pages are the latest preferred selection from the FAIRCHILD range. Many other silicon devices are available. If the product you need is not listed, call your local representative for immediate service.

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PART No.	Package	V_{CBO} (volts)	V_{EBO} (volts)	h_{FE} (typ.)	V_{CE} SAT (volts) max.	f_T (typ.) mc
SE1001	TO-18 epoxy	45	4·0	80 @ 10 mA	—	350
SE1002	TO-18 epoxy	45	4·0	200 @ 10 mA	—	350
SE1010	TO-18 epoxy	30	4·0	35 @ 2 mA	0·3 @ 10 mA	500
SE2001	TO-18 epoxy	35	4·0	100 @ 10 mA	0·7 @ 10 mA	300
SE2002	TO-18 epoxy	35	4·0	200 @ 10 mA	0·7 @ 10 mA	300
SE3001	TO-18 epoxy	30	2·0	50 @ 8 mA	0·6 @ 10 mA	Po 2mW @ 930 mc
SE3002	TO-18 epoxy	30	2·0	50 @ 8 mA	0·6 @ 10 mA	Po 8mW @ 930 mc
SE3030	TO-3 metal	150	5·0	150 @ 500 mA	1·0 @ 10 A	100
SE3031	TO-3 metal	150	5·0	125 @ 500 mA	1·8 @ 10 A	100
SE3032	TO-3 metal	60	5·0	150 @ 500 mA	1·2 @ 10 A	100
SE3033	TO-3 metal	60	5·0	120 @ 500 mA	1·8 @ 10 A	100
SE3035	TO-3 metal	40	5·0	150 @ 500 mA	1·2 @ 1 A	50
SE4001	TO-18 epoxy	30	6·0	220 @ 1·0 mA	0·35 @ 1·0 mA	50
SE4002	TO-18 epoxy	30	6·0	350 @ 1·0 mA	0·35 @ 1·0 mA	70
SE4010	TO-18 epoxy	30	6·0	350 @ 1·0 mA	0·35 @ 1·0 mA	N.F. 3db
SE5001	TO-18 epoxy	40	4·0	PG @ 45 mc 28 db	AGC @ 45 mc 8 mA	600
SE5002	TO-18 epoxy	40	4·0	PG @ 45 mc 28 db	AGC @ 45 mc 9·5 mA	600
SE5003	TO-18 epoxy	40	4·0	PG @ 200 mc 18 db	AGC @ 200 mc 9·0 mA	600
SE5020	TO-18 metal	20	3·0	NF @ 200 mc 2·8 db	PG @ 200 mc 25db	Cre (typ) 0·37
SE5021	TO-18 metal	20	3·0	NF @ 200 mc 3·5 db	PG @ 200 mc 25db	Cre (typ) 0·37pf
SE5022	TO-18 metal	20	3·0	—	PG @ 200 mc 21db	Cre (typ) 0·37pf
SE5023	TO-18 metal	20	3·0	NF @ 45 mc 3·0 db	PG @ 45 mc 25·5db	Cre (typ) 0·37pf
SE5024	TO-18 metal	20	3·0	NF @ 45 mc 3·0 db	PG @ 45 mc 25·5db	Cre (typ) 0·37pf
SE5025	TO-5 epoxy	30	3·0	Gpe @ 45 mc 28db	goe 200 µmhos	Cre (typ) 0·85pf
SE6001	TO-5 epoxy	40	5·0	80 @ 10 mA	1·0 @ 100 mA	50
SE6002	TO-5 epoxy	40	5·0	250 @ 10 mA	1·0 @ 100 mA	50
SE7001	TO-5 metal	150	5·0	60 @ 30 mA	2·0 @ 50 mA	60
SE7002	TO-5 metal	120	5·0	60 @ 30 mA	2·0 @ 50 mA	60
SE7010	TO-5 metal	150	6·0	90 @ 25 mA	1·0 @ 25 mA	90
SE8001	TO-5 metal	60	5·0	60 @ 150 mA	1·5 @ 1·0 A	60
SE8002	TO-5 metal	80	5·0	80 @ 150 mA	1·2 @ 1·0 A	60
AY8105	TO-5 metal	60	5·0	100 @ 300 mA	0·75 @ 1 A	40
AY8106	TO-5 metal	60	5·0	75 @ 300 mA	0·75 @ 1 A	40
AY1105	TO-5 epoxy	20	5 0	75 @ 250 mA	0·22 @ 150 mA	300
AY1106	TO-5 epoxy	−20	−4·0	70 @ 250 mA	−0·25 @ 50 mA	180

DIODES

PART No.	Package	BV	VF @ 1v	CO @ 0.v.	Trr
AN1101	TO-18 epoxy	60	1·0 @ 10 mA	3pf	5nsec.
AN1102	TO-18 epoxy	COMP. DIODE	0·6-0·64 @ 3mA	—	—
AN1103	TO-18 epoxy	50	10 mA	5pf	50 nsec.

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FCNC/3/66

Forum

Arising from a reference in "Answer Man", there was some discussion in these columns, a few months back, about "Alvin Generators" and devices or systems which could be used to produce vocal effects of the kind heard in the "Chipmunk" records. Two recent items from the technical press are worth repeating in the light of this discussion.

By W. N. Williams

In the January 12 issue of "Electronics Weekly" there was mention of the problem posed by "talking books" for the blind. Whereas a sighted reader might have an average reading speed of 300 to 400 words per minute, conventional speech for "talking books" is limited to about 160 to 170 words per minute. Therefore, added to all of his other problems, a blind person is at a 2:1 disadvantage in regard to potential "reading" rate.

If an attempt is made to offset this disadvantage by simply speeding up playback of the original recording, pitch rises, along with speed, to produce "duck talk."

The writer in "Electronics Weekly" goes on to point out that research into the manipulation of speech waveforms, originally aimed at making better use of voice transmission channels, might solve the problem of the blind by giving them speech accelerated in syllabic rate but not noticeably altered in pitch.

He refers specifically to the work of R. L. Miller (Bell Labs., 1938), B. P. Bogert (1955) and Schroeder, Logan and Prestigiacomo (1962) which led to the idea of halving the frequency components in speech, transmitting them over carrier channels of half the normal bandwidth, and then restoring them at the other end to normal pitch.

For "talking books" the first half of the process would be used to produce half-frequency speech at the normal, syllabic rate, which would be recorded on tape. It would then be played back at double the original recording speed, restoring the pitch to normal, but doubling the syllabic rate. The new word rate of about 320 would approximate that of a sighted person reading (but not enunciating) the same text.

Behind this proposed manipulation lies a requirement for much research and circuitry, if the end result were to come up to expectations. The basic problem is that frequency doubling and halving involves introducing severely non-linear elements into the signal path, leading to heavy distortion and intermodulation. The end result would be quite unusable if special precautions were not taken.

The system evolving from the above-mentioned Bell research envisages feeding the speech signal into a bank of 36 filters, which would divide it up into frequency segments only a fraction of an octave wide. The contents of these very narrow frequency segments would then be separately halved or doubled, as required, all direct harmonics being excluded by the filters and intermodulation products minimised by the limited content and bandwidth of each segment.

Reconstituted, the end result would presumably be acceptable in terms of communication speech quality.

Equally, of course, such manipulation would lend itself to gimmick effects, if this was the end requirement.

But 36 circuits, complete with multiple filters, halvers, doublers, amplifiers, etc., would add up to a fair order of complication and not the kind of thing an experimenter might knock together for a bit of fun.

So much for the filter approach, which one might put down as an interesting but logical extension of ideas which have been current for quite a few years. Most intriguing was an item in the March, 1966, issue of "Audio" magazine, authored by E. T. Canby. Because of lack of space, I cannot hope to reprint it "in toto" but will do my best to condense it without sacrificing the basic information.

Canby says that he was intrigued, about two years ago, by a reference somewhere to a piece of professional tape-recording equipment with the reported ability "to change program length without changing pitch. To change pitch, without changing program length." Ultimately he tracked the device down to Gotham Audio and finally got to see and hear their "Eltro MLR 38/15 Tempo and Pitch Regulator" — since displaced by a similar but more streamlined machine.

The equipment relies for its operation on a set of rotating playback heads, reminiscent of those used in helical scan video recorders but differing in that the Eltro heads scan lengthwise along the tape and along conventionally recorded tracks. In a way, the action is similar to the street-cleaning machine, whose power-driven brushes scan the pavement at a far greater speed than that of the vehicle on which they are mounted.

The Eltro Regulator has four heads aligned 90 degrees apart, mounted on a revolving drum. The tape wraps 90 degrees around the drum so that as one head leaves the tape, the next picks up the taped signal without significant break in the continuity of output.

If the head drum is rotated with the tape held motionless, a very small segment of tape is scanned over and over again; the output from the series-connected heads is a continuous signal as the recording on the segment is repeated ad lib. Spin the drum faster and the apparent pitch of the signal rises; spin it slower and the pitch falls — all from stationary tape!

At one critical setting, with the heads scanning, say, a 15ips tape in the correct direction for replay and at a peripheral speed of 15ips, the segment is repeated at the correct speed and pitch. It is like repeating one groove from a faulty gramo. record, except that the tape repeats are of much smaller time duration, tending to blend one into the other.

Now start moving the tape, as the heads continue to rotate at the above-mentioned critical speed. Instead of getting a continuous replay of the same tape segment, you get progressively overlapping segments which take in more tape as the tape speed builds up.

At the same time the "average" pitch rises, because the pitch is basically dependant on the relative speed of tape surface and scanning head(s).

When the tape speed has reached its normal 15ips, the syllabic duration of the speech recorded thereon is normal. That is to say, what took five minutes to record originally, takes five minutes to play back. But while the syllabic tempo is normal, the heads scanning the tape at double speed, have come up with a kind of double frequency version of the recorded signal.

The phrase "double frequency version" is used because, in no sense is the composite signal from the heads a direct read-out of what is on the tape. Rather is it a pot-pourri of short, overlapping segments, in which some or all of the material appears twice in the

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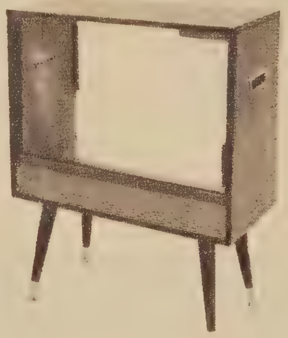

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Please add $2.00 N.S.W., $4.00 Vic., Qld. $10.00 E'where.

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2 x 215v 6.3v sec.
Only $3.50
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$6.00
Add 40c postage.

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240v to 117v.
Ideal for small conversion.
$1.00
Add 20c.

Small chassis complete with socket and bottom cover, two relays and tag strips.

11in x 3in in size, real handy.
$2.00
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Stereo portable case with two detachable speaker boxes that form the lid of same.
Not covered but easily finished by handyman.
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.001 mf 400v 20/80c.

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TV1970 (equiv.)
Suit latest 23in N.S.W. **30c**
Vic., **40c**; W.A., **60c.**

TRANSISTOR SPECIAL

0C 44 OC 71 OC 74n SFT 121 SFT 317 ...... 65c each
Add 20c. Minimum order of 5.

PHILIPS TUNER

3011
As new tested
With valves.
$15.00
Add $1.00 Postage.

PHILIPS TUNER

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As new tested..
With valves.
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500 k with switch.
80c
Add 10c post.

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Relay operated
A gem . . .
2.000 ohms coil
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16k to 3.7 ohms.
50c
Add 20c Postage.

NEW VALVES

1X2 b	$1.20
6CQ6 (6AM6)	60c
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From OC71 to 2x OC74
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2 pin speaker plug

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With polarity prov. 10c

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200 mA.
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$8.00
Add $1.00 N.S.W.; $2.00 Vic., etc.

Electrolytic Special

24mf, 450v/w	**60c**
50mf plus 8 mf plus 24mf	**80c**
24mf plus 8mf plus 50mf 20v,	**80c**

Add 20c Postage.

REMOTE CONTROL

motor 24V ac.
Ideal for TV and hobbies. Complete with gearbox in original condition.
$1.00
Add 20c.

output, having been scanned at different times by different heads.

The system stands or falls on the assumption that the repeated bits of information will be so close together in time and character that their repetiiton will be blended together smoothly by the ear into a modified but still acceptable result. A rough analogy can be suggested with movie film, especially as presented over 60-field television systems, where individual frames are presented twice or three times, still being blended by the eye into smooth movement.

If the heads are rotated in the same direction as the tape, so that they scan the tape at less than the original recording speed, the pitch is reduced below normal. The composite replay signal now leaves out small segments of the original material but, again, the assumption is that the ear will blend the end result ino a modified but acceptable sound.

In practice, the Eltro machine can directly raise the pitch of recorded material by seven half-tones, equal to an interval of a fifth or a frequency ratio of 1½:1. It would therefore appear to offer less potential in this direction than the filter-doubler system mentioned earlier.

However, it can lower the pitch (speed or tempo remaining unchanged) by up to three octaves, representing a frequency ratio of 8:1.

In his account of the machine's performance, E. T. Canby says that the end effect is amazingly smooth, with no hint of "wow" effects from the in-built adjustable facilities.

It is possible to hold the pitch rock steady and either speed up or slow down the speech and music, just as if the original performance had varied from the hectic to a dawdle.

Or, with tempo fixed, a soprano can be lowered progressively in pitch till she sounds like a basso profundo!

With this facility to hand, one can obviously go ahead and, by means of modified pitch, re-recording, accelerated or decelerated playback and double recording, produce all kinds of gimmicked effects.

Canby says that, to this point, the techniques can be duplicated, probably without running foul of patent situations. However, the Eltro machine incorporates certain novel mechanical features, which contribute to performance, versatility and ease of control.

Its basic drive comes from a 900 rpm motor in which both the rotor and the stator shell are free to spin. It is immaterial to the operation of the motor whether either or both rotate; it simply establishes between the two an "internal" synchronous speed of 900 rpm.

The rotor drives the tape capstan while the stator is geared in a specific ratio to the rotating head drum, thus establishing a basic (and carefully planned) relationship between tape traverse speed and drum scanning speed.

The stator, or outer shell of the motor, is coupled, in turn, to a second motor through a planetary friction-drive arrangement which allows it to be driven backwards or forwards at any desired speed, or held stationary.

If it is held stationary, the rotating heads also remain stationary, and the capstan spins at 900 rpm relative to the outside world. This gives a tape traverse speed of exactly 15ips and the output is a normal-pitch, normal-speed replay of what is on the tape—with possibly a slight echo content, according to the position of stationary heads actually in contact with the tape loop.

(I take it, from the context, that normal procedure is to use the Eltro in conjunction with a normal professional tape recorder, the tape being routed from the supply spool of the original recorder, through the capstan and scan system of the Eltro and thence back to the original take-up.)

If the shell is now driven forward, the capstan must speed up to maintain the inherent 900 rpm of the main motor. Thus the tape travels faster but, because the heads are travelling in the same direction to maintain the same scan speed, pitch remains unchanged.

If the shell is driven in reverse, the capstan slows down by an equivalent amount (as far as the outside world is concerned) the tape travels slower but, once again, pitch remains unaltered.

In short, by simply controlling the speed and direction of the outer shell of the 900 rpm motor, tape traverse speed is varied and therefore the tape playing time is stretched or compressed, with equivalent effect on the tempo of the recorded material. However, the capstan-to-drum interlock provided through the 900 rpm motor, maintains the pitch absolutely constant. You thus end up with a single-knob control of playing time and tempo, with pitch unaltered.

If the requirement is to leave tempo unaltered and vary pitch, the normal procedure is to ignore the Eltro's own capstan, controlling tape speed by means of the external recorder. The tape is passed around the Eltro's scanning drum, however, and head speed and direction varied according to requirements. This gives a playback which is locked in terms of playing time and tempo but variable in pitch between the limits mentioned earlier.

E. T. Canby concludes his story with the suggestion that this sort of technique may find application in a variety of fields but also warns that it is not for home use—unless you have the kind of home that is equipped as a matter of course with a lot of other expensive things — mammoth swimming pools, yachts and other such what-nots!

To get away briefly from audio and to other matters, the letter at the head of this page takes up the question of the reliability of the SSB (single sideband) equipment under field conditions.

As you might have guessed, the writer listed the brands and type numbers of the equipment in use, but I elected to delete these. While our correspondent seems to have had a poor run from the SSB equipment, it is hardly fair to publish a damning opinion about a line of equipment, based on experience with just two or three sets in a particular environment.

(Continued overleaf)

SSB EQUIPMENT IN THE DESERT

Dear Sir,

As a long time reader of your magazine I am prompted to pass on to you some observations I have made on communications equipment.

Firstly some background; I am in charge of one of two Seismic survey crews operating in the Simpson Desert about 300m S.E. of Alice Springs. The two camps move at irregular intervals and may be up to about 150 miles apart.

As with most oil exploration activities in the area, primary communication is bv radio, using four frequencies in the range 3.5-12MC, using SSB upper and lower side bands giving 8 "channels." Fixed stations are located in Alice Springs and Brisbane. About four other exploration companies are using the same frequencies, with various portable stations and fixed stations in Brisbane, Darwin and Alice Springs.

For emergency and medical communication both our crews are equipped with sets operating in the R.F.D.S. (Royal Flying Doctor Service) network at Alice Springs, using AM on 2020, 5410, and 6950KC. These are carried by survey crews, etc., who are away from camp for several days at a time in a "trackless waste of sand," where lack of communication in the event of breakdown or injury could be fatal.

Under similar circumstances I have observed that reliability of communication is about the same for both modes of transmission, excluding frequency of equipment failure.

The SSB transceiver, rated at 100 watts PEP, weighs about 170lb, measures about 30in x 30in x 24in, and requires about 500 watts at 240V AC. Cost is about $1,400, the aerial is critical, requiring a technician from town to readjust the set every time camp is moved. Also the set is very sensitive to dust and quits working at about 115 deg. F. Being run from a generator means it always has interference.

By contrast, the AM set weighs about 10 pounds, measures about 3in x 9in x 6in, takes about 100 watts at 12V DC. (This is easier to come by in the desert than 240V AC). Cost of the set is about $370; the aerial can be simply 30 feet of wire draped over bushes or supported by a tent pole. Anyone can load it by following the instructions in the lid. Of three of these sets which have spent much of the last nine months loose under the seats of trucks on very rough "roads" we have had only one breakdown.

On the other hand it seems that the SSB sets are almost always broken down, even in the ideal conditions of our Alice Springs office.

From the above I am forced to conclude that however desirable SSB is technically, for field conditions it is not yet practical. The only reason for using the SSB network is the restrictions on direct communication using the R.F.D.S. sets.

Maybe you would care to comment on the above. Also there is a rumour in Alice Springs that the R.F.D.S. will be changing to SSB in the foreseeable future; if this is so, equipment will have to improve dramatically, particularly portable equipment, and also decrease in price.

Yours faithfully, J. D.

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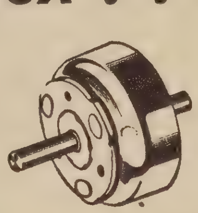

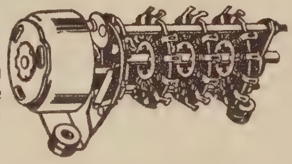

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Other Ledex products are ready to work as compact solutions to your circuit switching applications. Write or phone for literature mentioning applications to . . .

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M488 MSP 11-63

FORUM — continued

The verdict of other users in other situations might be quite different.

However, our correspondent has been moved to express the opinion that SSB equipment may not be a good choice, as yet, for commercial use in bad environmental conditions. In particular, he expresses concern at reports that the Roya Flying Doctor Service is contemplating a changeover to SSB equipment.

Of this last point I have no knowledge, although I do know that many communications engineers regard SSB as the logical next step for all kinds of systems, to get the most out of their ever-narrowing slices of band-space.

Whether this kind of thinking is justified in the central Australian desert is quite another thing, because space in the bands may be much less of a problem than space of the geographical variety! What do other readers think?

And now, from SSB to advertising.

Our editorial in the March issue, on this general subject, invoked a certain amount of comment, most of which confirmed our original reasons for saying what we did.

It's a fact that quite a few readers obviously did not understand that magazines and newspapers have to sel advertising space to stay in business. Many more did not understand that, having bought space in a publication, the advertiser has a large amount of liberty as to how he will use it. Advertisers decide what they want to say, submit their own copy, pictures and layout correct their own proofs.

Out of sheer necessity, advertising

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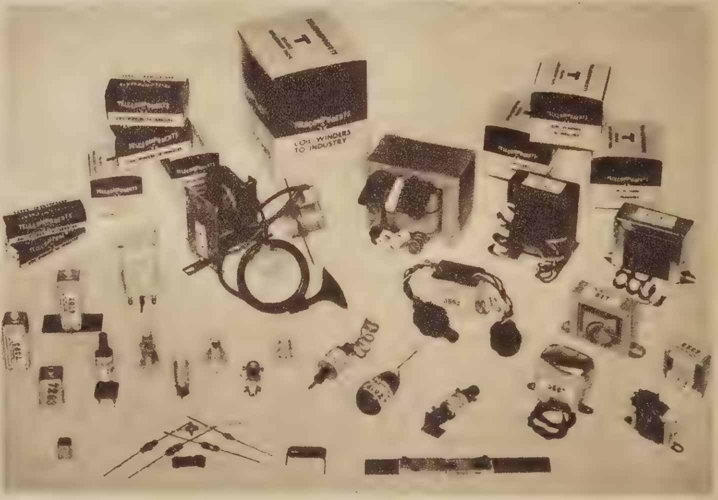

W.F. are distributors of this renowned range of Television and Radio Transformers. Complete range available from stock.

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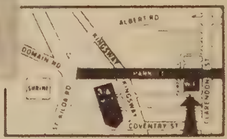


WRITE OR CALL FOR CATALOGUE AND PRICE LIST

• TRADE ALSO SUPPLIED

WFE/4

material has to be published on a "good faith" basis, always remembering that most people, trying to sell something, are outspoken in praise of the item and reticent about its limitations. As mentioned in the editorial, it would simply not be practical for a magazine publisher to establish the basis of every statement, specification and price contained in the advertisements.

A letter to hand from a reader in Regents Park, N.S.W., highlights the problem and gives reason for its closer examination. I quote:

Sir,

The editorial for March, 1966, placed considerable emphasis on the fact that advertisers generally had a pretty free rein regarding the contents of their advertised material. The editorial concluded by saying that malpractice by advertisers would not be tolerated and, if detected prior to publication, would be eradicated.

After browsing through many magazines, I found numerous quotations by advertisers which could be considered doubtful as regards their authenticity. Possibly many other misleading statements would not be considered serious enough to require correction but, nevertheless, such things can lead people up the garden path.

Claims by various tape recorder manufacturers in regard to the frequency response of their products, if taken on face value, could lead to disappointment.

A recent claim by the distributors of ——— recorder states that the frequency response at a tape speed of 7½ips is 30 to 24,000cps. This claim, if correct, is quite impressive but the added statement that the machine operates also at 15ips made me think twice about buying one of these recorders.

My reasoning is based on the idea that the human ear will respond to sound vibrations between roughly 16 and 16,000cps so, in actual fact, we only require equipment to be able to reproduce frequencies that are audible to our ears.

If the ——— recorder is capable of reproducing the 30 to 24,000cps frequency range at 7½ips, why have a speed of 15ips? Surely we do not wish to reproduce frequencies that are not audible to us?

Yours faithfully, J.M.

While I hadn't noticed the particular point raised by our correspondent, it doesn't at all follow that it betrays a falsehood.

To be sure, recording and playback at 7½ips and a response to 24KC should meet all hi-fi requirements, with something in hand to cover losses due to other than optimum tape and so on. I can't imagine an amateur enthusiast wanting to use the highest speed.

If used in a professional environment, however, the higher speed could be important purely on the grounds of compatability with other recorders.

Again, for tape copying, the ability to copy 7½ips tapes at double speed, without significant fidelity loss may be important.

There is the still further possibility of needing a recorder for information other than sound.

Even the idea of having a response far in excess of the audible range is not too crazy. One can buy an argument any day in regard to audio amplifiers which have a claimed response way up into the supersonic region. What's good for the goose . . . &c.

Australia buys Solartron's largest ATC simulator

On page 12 of this issue is an article on Simulation. After the pages were complete and just before this issue went to press, the following news item came to hand:

The largest analogue ATC (Air Traffic Control) simulator so far produced by Solartron, a 24 target machine capable of simulating supersonic aircraft, is to meet an export order from the Australian Department of Civil Aviation.

Commenting on the contract, Mr. N. R. Harrison of Solartron said: "When supersonic aircraft come into operation, the Australian route will certainly be one of the first they will operate. The Australian air traffic controllers must be in a position to cope with it when this arises and they can only do this by simulator training."

Value of the contract is in the region of £40,000 (sterling) and delivery is scheduled for the early part of 1967.

Within a "playing area" 400 by 400 miles, each of the simulated aircraft can operate at heights up to 50,000 feet and speeds up to 3000 knots.

Apart from its role in training, a prime function of the simulator will be the evaluation of ATC procedures and practice approaches to major Australian airports.

In short, the advertiser could rightly claim that the statement was neither misleading nor illogical and that he had every right to make it in his own advertisement.

But let's say that the Editor not convinced, decided to check out the frequency response.

Straight away, he would be faced with the problem of getting hold of one of the units for urgent examination and test, preferably a unit from an unopened carton. With a newly released product, this is problem enough when the distributor is actively co-operating to make a unit available for a product review—let alone when their bona fides are being callest into question.

Having duly obtained the recorder, the Editor then has to arrange for a technician, laboratory space, instruments and time to run the tests. This adds up to quite a few hours and dollars.

But it isn't always clear sailing, as we have discovered in carrying out product reviews. Because of progressive refinement in tapes and the need to observe optimum bias level conditions, the last couple of KC of response may not be forthcoming on the test tape which we have elected to use. So one has to begin backtracking to discover whether: (1) Some other brand and type of tape should be used; (2) the machine is a below-par sample or maladjusted or (3) the specifications are exaggerated.

Then there's the problem which we have mentioned on occasions in reviews—namely that some recorders only show the claimed response when the test tone is maintained well below the 0dB on their level meters. Their manufacturers claim that this is a legitimate proviso, because the energy level of high frequency sounds in program material is quite small.

Other manufacturers neither impose nor envisage this condition.

Try to trace this one out and you find yourself in spirited arguments, involving rival interests, as to whether the condition is fundamental to the recording process, a by-product of the level meter frequency response, a basic limitation and, if so, of what order.

By the time you've argued this and, incidentally, whether the response should carry reference to dB limits, at least a day of time and salary has been dissipated — all for one response curve from one recorder.

If the advertisement refers to more than one recorder, more than one response and specifications covering power output distortion, wow and flutter, &c., checking it out would multiply from a day into days, with lab. staff, space and equipment to suit.

Now recall that this issue, which you are reading, contains the equivalent of 85 or more pages of advertisements and the impossibility of checking them all out become obvious.

Just to round off this rather lengthy instalment of "Forum," I have a letter to hand from a reader, M. McW. of Cottesloe, Western Australia. He says that, in his experience, the technical quality of music heard through a radio tuner is always better than anything he can obtain from records in his own home. What is the reason for this seeming anomaly?

First of all, there is no real anomaly to explain. The quality to be had from good records played on good equipment is normally better than can be heard through a radio tuner and the margin becomes very wide if one allows that the recordings can be in stereo.

Seeking an explanation for M. McW.'s bewilderment I would put forward three propositions for examination:

(1) The pickup is of poor design or faulty, or our correspondent's choice of records has been singularly unfortunate. Again, there may be some anomaly between pickup and amplifier input, such that distortion is occurring or serious frequency unbalance.

(2) The pickup may be of a type which produces significant acoustic output from the stylus assembly. This direct needle buzz can be most disturbing, if heard in a quiet room, along with the normal reproduction. Old style pickups are prone to this effect and should be used under a close-fitting lid. Pickups as old as this would be quality-suspect anyway, these days.

(3) M. McW. may simply be averse to sound reproduction containing higher frequencies and prefer the "mellow" tone resulting from severe sideband cutting in the average radio tuner. This condition could be simulated by heavy top-cut tone control but, while some may prefer this kind of sound, it is certainly not true-to-life sound.

The answer to our correspondent's dilemma may be found in one or more of these propositions, or there may be some other explanation. I can assure him, however, that the problem lies in his original postulation, not in the anomaly which it seemingly presents.

A THREE-BAND SHORT-WAVE CONVERTER

By Keith Woodward

In our April 1966 issue we described a three band superhet receiver using a printed wiring board in the bandswitched front end. After finishing this project we realised that the same printed board, with very minor modifications, would make an ideal building block for an improved short-wave converter incorporating three bands.

We have presented several short-wave converters in the past but we felt that the simplification made possible by the use of a printed wiring board more than justified presentation of another one. In addition, we envisaged some worthwhile advantages resulting from the availability of three bands.

Since it is no longer necessary to cover the broadcast band—this being provided by the receiver with which the converter will be used—the three bands are now available to cover the normal short-wave range, up to about 21MC or so, giving a number of advantages over the usual two-band coverage.

One of these is the possibility of extending the coverage to include the University of the Air broadcasts on 1750KC. These broadcasts have been quite popular in N.S.W., and there have also been reports of extended coverage.

Another advantage is the greater bandspread which can be achieved over the frequencies covered. This in turn allows easier selection of stations, with less dial cramping than in wide coverage tuners.

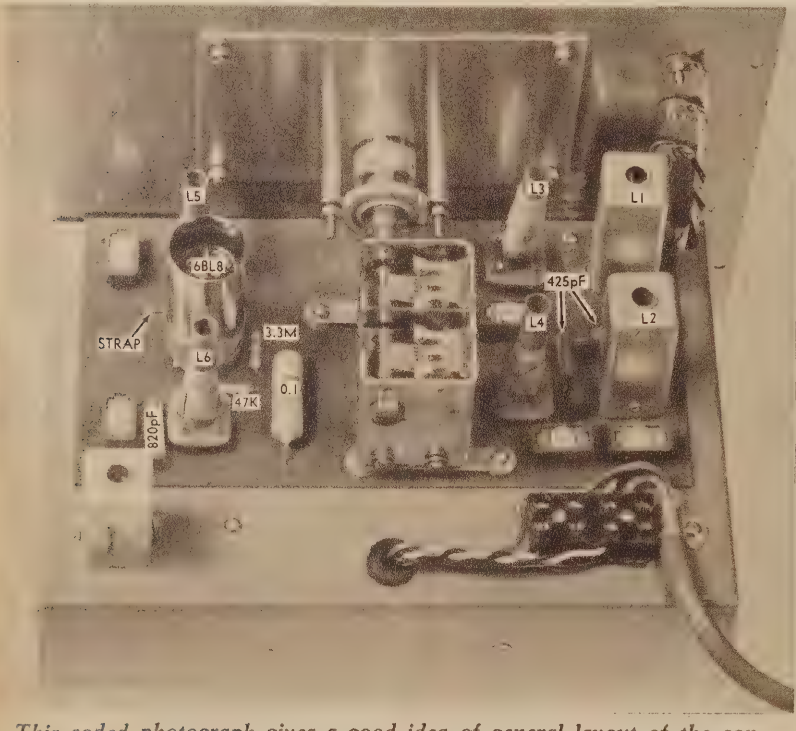
One way to achieve this greater bandspread is to use a smaller than standard tuning capacitor. An investigation into the supply position revealed a tuning capacitor, made available by Watkin Wynne, with a maximum capacitance of 200pF. Using this capacitor it is possible to obtain three tuning ranges of approximately 1.7 to 3.9MC, 3.8 to 8.7MC and 8.7 to 21.5MC.

The bandspread action of the smaller gang is further enhanced by the log dial used. This dial, obtainable from the same source as the tuning capacitor, has two tuning rates 6:1 and 36:1 allowing stations to be selected with comparative ease. Further vernier tuning can be obtained by slight retuning of the receiver into which the converter is fed.

The broadcast/short-wave switch on the front panel switches the antenna to either the converter or the broadcast set and at the same time switches the converter on or off. A coaxial socket is provided for the output of the converter and this should be connected to the aerial of the broadcast receiver with light duty coaxial cable. In districts located near high power broadcast stations it may be desirable to extend this coaxial cable right to the aerial coil of the broadcast receiver.

A neon lamp indicator is illuminated when the converter is switched on and acts as a reminder that it is running. Previous short-wave converters used an output frequency close to 1600KC but, as we wished to cover down to 1700KC, it was decided to use an output frequency of approximately 1350KC. Should a local broadcast station be located on this frequency it is quite in order to shift the output frequency up to 50KC either side of this figure.

The short-wave converter acts similarly to the first stage of a superheterodyne receiver. The incoming signal is fed to the control grid of a mixer where it beats against a locally produced signal to produce an additive and difference frequency in the plate circuit of the mixer. For instance when the converter is tuned to the University of the Air broadcast on 1750KC the local oscillator is tuned to 3100KC. In the plate circuit will appear the additive frequency, 4850KC and the difference frequency 1350KC as well as the original signals and minor heterodynes.



This coded photograph gives a good idea of general layout of the converter. The 100K screen supply resistor and .01uF by-pass are obscured by the 6BL8, behind which they are mounted.

If a selective circuit is used in the plate circuit and tuned to 1350KC the other frequencies will be attenuated. This circuit, when coupled correctly to a broadcast receiver also tuned to 1350KC, allows the original signal of 1750KC to be heard. The oscillator and aerial stages are ganged in such a manner that a constant difference frequency of 1350KC is maintained throughout the tuning range of the converter.

To maintain correct tracking between these two ganged circuits, allowance must be made for the fact that the tuning range of the two is not the same. For instance, the tuning range from 3.8 to 8.7MC, as covered by the aerial tuned circuit, represents a ratio of 2.3 to 1 (approx). However, the oscillator circuit for the same range tunes from 5.15 to 10.05MC, a ratio of only 1.95 to 1. Thus, the identical gang sections are not suitable for directly tuning both circuits, if the latter are to be kept in step.

There are two common methods for overcoming this difficulty; the use of two dissimilar capacitors ganged together, or the use of a "padding" capacitor in the oscillator circuit. We have adopted the second approach, which involves wiring a capacitor in series with the oscillator tuning capacitor. This capacitor must have a value which will restrict the tuning ratio of the oscillator as specified above.

This method of oscillator compensation gives what is referred to as three-point tracking, which means that the circuit, if designed correctly, will give exact frequency relationship near both ends and at the middle of the tuning range. There will be small variations between these points but not enough to cause any appreciable loss of signal.

As the tuning ratio will vary for different bands it is necessary to select individual padding capacitors for each band.

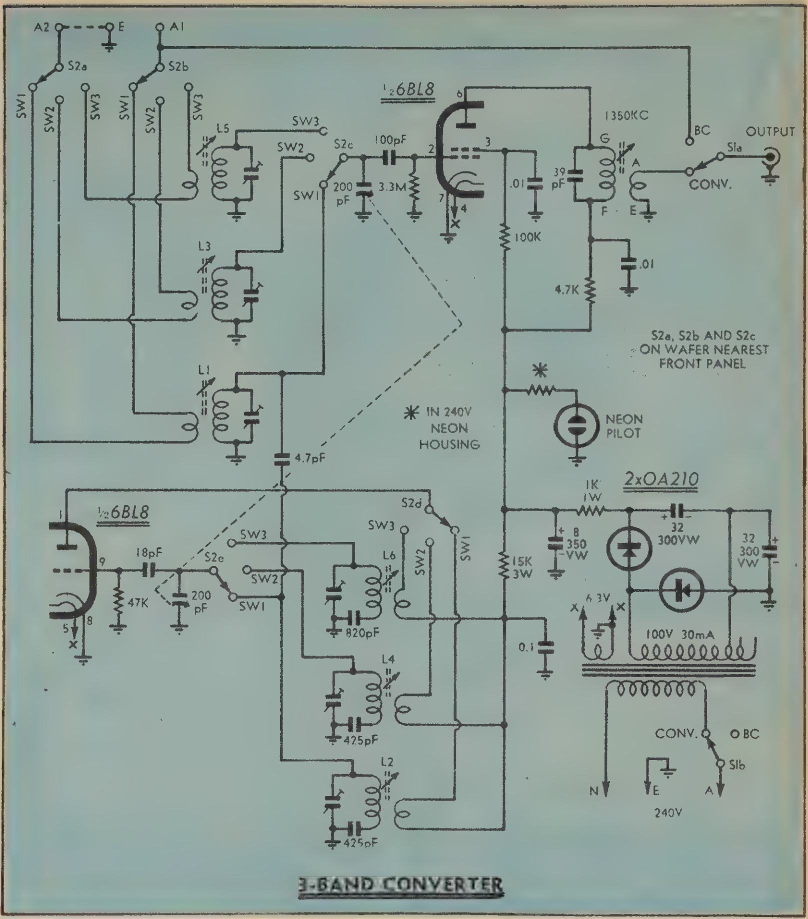
There are several types of mixer/converter circuits which may be used in a receiver. However, all mixers produce noise, some more than others. The use of an RF amplifier stage in front of a mixer usually gives sufficient amplification of the signal to overcome the noise of the mixer. Since we do not have an RF amplifier stage it was necessary to select a mixer with, among other things, good noise characteristics.

As a triode valve is also required for the oscillator, one of the modern triode-pentode combinations seemed a logical choice. The 6BL8 in particular is attractive, as the pentode section makes a good low noise mixer, and the triode an excllent oscillator, able to function well into the VHF region.

On the lowest frequency band a small capacitor couples the oscillator grid to the mixer grid to provide optimum injection. However, sufficient stray coupling is present on the other two bands to provide adequate injection without external coupling. In fact, if further coupling is provided, it may reduce the efficiency of the mixer. The mixer circuit is relatively insensitive to injection voltages compared with other circuits and very little difference in conversion efficiency is noted across each band.

The aerial and oscillator coils are wound on miniature RCS coil formers, type 509, and if substitutes are used care should be taken to obtain the same pin layout. While bands 2 and 3 coils were hand-wound, the lower frequency coils were made by stripping turns off standard broadcast coils. It is possible that pre-wound coils for this converter may be made available through trade houses.

The printed wiring board was originally designed for a circuit in which one end of the aerial primary winding was connected to chassis, as is used, for example, when the set is used with a coaxial aerial feeder. While this seemed the most likely arrangement to be used with the receiver described in the April issue we felt that a converter would be used by a wider range of readers, and that there was at least an equal chance that they may want to use it with a balanced feeder.



The circuit is quite conventional but a number of details are worth noting. The 6BL8 was selected for its low noise characteristics while the provision of three bands and small (200pF) tuning capacitor gives extra coverage with good band spread.

PARTS LIST

1 Standard instrument case, 9in x 6½in x 5½in, complete with front panel and chassis.
1 Log dial with vernier drive.
1 Two gang tuning capacitor, 200pF per section.
1 Two wafer bandswitch, 3 pole 3 position wafers (see text).
1 Neon in bezel complete with series resistor.
1 Power transformer, 240VAC primary, 100V 30mA secondary, 6.3V secondary.
2 Broadcast aerial coils, miniature.
1 Broadcast oscillator coil, miniature.
4 Miniature slug tuned coil formers (RCS type 509 or similar).
1 Printed wiring board.
1 6BL8 valve.
1 9 pin valve socket suitable for printed wiring board.
2 OA210 diodes or equivalents.
3 Spring-loaded terminals, two red, one green.
1 Belling-Lee coaxial socket.
2 Knobs.

CAPACITORS

6 5-30pF compression trimmers.
1 4.7pF NPO ceramic.
1 18pF NPO ceramic.
1 39pF silver mica or plastic.
1 100pF silver mica or plastic.
2 425pF silver mica, 5 per cent.
1 820pF plastic or silver mica, 5 per cent.
2 .01uF, 350VW ceramic.
1 .1uF 400VW, paper or plastic.
1 8uF 350VW pigtail electrolytic.
2 32uF 300VW pigtail electrolytics.

RESISTORS

1 1K 1W.
1 4.7K ½W.
1 15K 3W.
1 47K ½W.
1 100K ½W.
1 3.3M ½W.

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Tagstrips, hookup wire, screws, nuts, solder, rubber grommet, etc.

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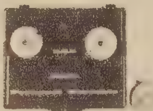

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6 transistor
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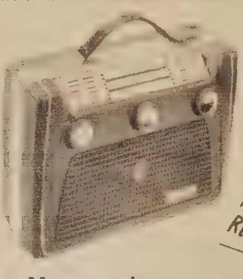
From your drawings. Price: $10 set up charge plus 30c for each print 5 sq. in. and under. For prints over 5 sq. in., add 2c per sq. in. Drilling, plating, coding, price on application.



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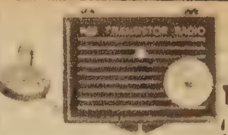

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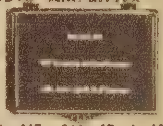

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The same with Goodmans Twinexiette—less £3. The same with B & O diamond magnetic cartridge. Less (£9) $18.

2 Star SA30 Amplifier, Dual 1010 turntable, Decca Deram cartridge 2 Goodmans Twinexiette 8in speakers.
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3 Armstrong 222 amplifier, Garrard AT6 turntable, Decca Deram cartridge. Wharfedale 8in Bronze speakers. **$202**

The same with Wharfedale Super 8in speakers or Goodmans 8in Twinexiette speakers (£109) $218.

4 Grundig TM 45 Tape Deck, complete to be plugged in amplifier for recording or playback, Armstrong 226 Stereo 10 watt per channel, magnetic input broadcast FM stereo tuners, Goodmans 10in Twinexiette speakers. P.E. 34 Hi-Fi turntable with Empire 888 cartridge. TOTAL £275 **$550**

The same without Tape Deck. Less £90. The same with Dual 1009 turntable and B & O cartridge. Less £10. The same with Dual 1010 turntable and Decca Deram cartridge. Less (£25) $50.

5 Sansui SM 34, Labcraft 605 L turntable, All Balance arm, B & O diamond cartridge, 2 Wharfedale 12in RS/DD speakers.
TOTAL £175 **$350**

The same with Armstrong 226—plus £10. The same with 2 Goodmans Twinexiette 10in speakers £152, $304. The same with Pioneer 204B amplifier—less (£10) $20.

6 Truvox P.D. 104 Tape deck. Leak Stereo 30.
TOTAL £253 **$506**

The same with Armstrong 221—less (£30) $60.
The same with Dual 1009 turntable and Empire 888 Cartridge. Plus (£50) $100.

7 **SPEAKERS IN STOCK—New shipment** of Tannoy 10in, 12in and 15in dual concentric Hi-Fi speakers just arrived from England. World's best speaker system in stock. Empire (U.S.A.), Heco (Germany), Isophen (Germany). Wharfedale and Goodmans. **AMPLIFIERS IN STOCK**—Armstrong (England), Harmon Kardon (U.S.A.), Leak (England), Quad (England), Pioneer (Japan), Sansui (Japan), Star (Japan), Perpetuum-Ebner (Germany), Peak (Japan). **TURNTABLES IN STOCK**—Perpetuum-Ebner (Germany), Dual, Labcraft, Garrard, Empire, Goldring, Orpheus Silex. **PICK-UP ARMS AND CARTRIDGES**—World's best cartridge—Empire, Ortofon, Elec, B & O, Shure, P.E., Dual, Grado, Decca Deram. **TAPE RECORDERS**—Ampex, Akai, Grundig, Seimens, Tandberg, Truvox. **READY-MADE STEREOGRAMS**—Nordemende.

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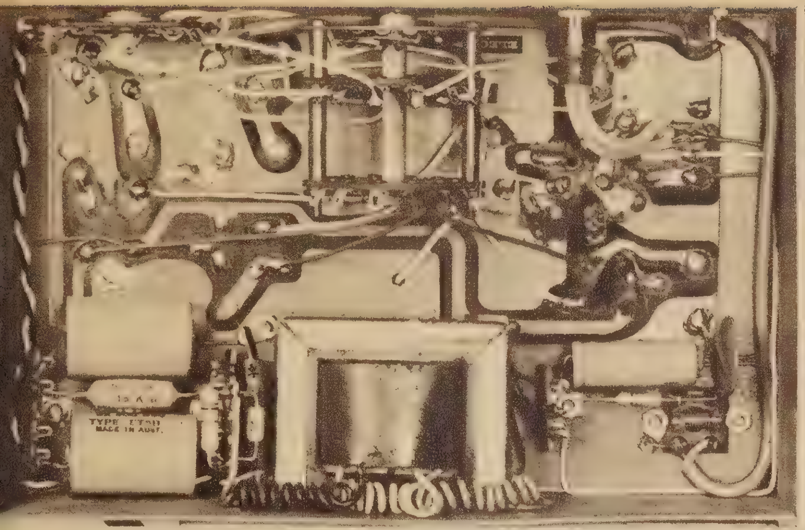


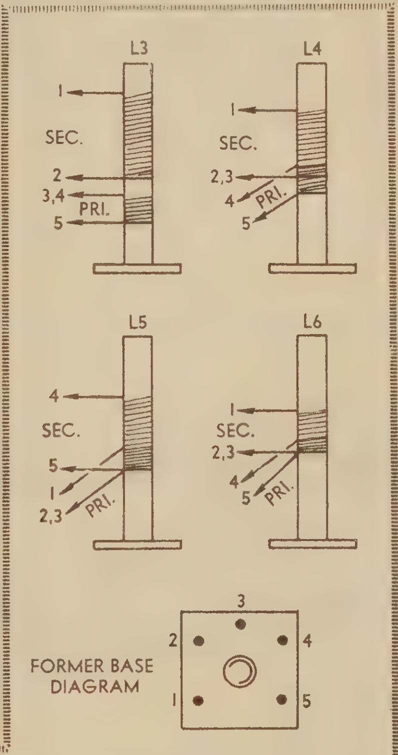
As well as the wiring and components on the printed board, the under-chassis accommodates the wave change switch, power supply, and associated wiring. Most of it is shown in this photograph.

Since this requirement was not envisaged when the printed board was originally designed, it is necessary to modify it slightly, to allow isolation of he normally "earthy" primary winding base pin. This is done by simply drilling oversize holes for these pins, allowing hem to be insulated with a section of leeving and wired to the switch as hown in the circuit.

Another alteration required to the oard is a strap from the AGC connection, at the bottom of the mixer grid esistor, to chassis. This involves only short piece of wire between the two oints on the printed wiring board.

The ouput coil of the converter is a tandard broadcast aerial coil, used back-to-front," with a 39pF across the arger winding to enable it to be slug uned to 1350KC.

The dial used is the same as that eatured in our three band receiver of April, 1966. This dial has a metal backng plate on which the drive mechanism s mounted. We found that this made



L1 Miniature broadcast aerial coil modified as follows: TUNED WINDING—remove complete top pie and 25 turns off second pie; AERIAL LINK—remove 70 turns.

L2 Miniature broadcast oscillator coil modified as follows: TUNED WINDING—remove 55 turns; PLATE COIL—remove 10 turns.

L3 Tuned Winding: 40½ turns 31SWG enamelled copper wire closewound. Aerial Link: 16 turns 31SWG enam. copper wire closewound and spaced 1/8in from tuned winding at earthy end.

L4 Tuned Winding: 32½ turns 31SWG enam. copper wire closewound. Plate Coil: 11 turns 31SWG enam. copper wire closewound, 5 turns below tuned winding and 6 over tuned winding at earthy end. Insulate between windings with plastic tape.

L5 Tuned Winding: 15½ turns 26SWG enam. copper wire space wound wire diameter between turns.
Aerial Link: 5½ turns 26SWG enam. copper wire interwound in earthy end of tuned winding.

L6 Tuned Winding: 14½ turns 26SWG enam. copper wire space wound wire diameter between turns, and bound with layer of plastic tape. Plate Coil: 5 turns 26SWG enam. copper wire interwound in earthy end of tuned winding.
All windings above wound in the same direction.

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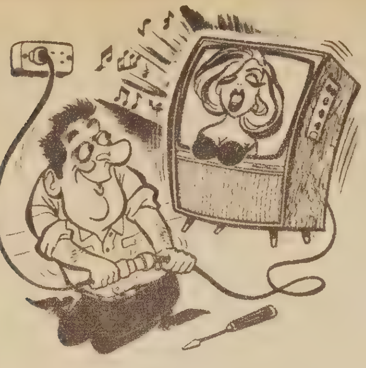

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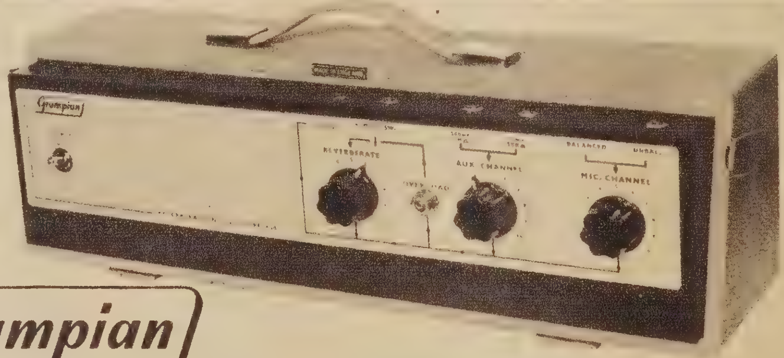

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the task of aligning the dial drive to the tuning capacitor extremely simple. Remove the knob, cursor, plastic cover, and cardboard sheet from the main mechanism, leaving assembled the backing plate and vernier drive. This section may now be mounted on the tuning capacitor shaft.

Next, cut a clearance hole of approximately ¾in in the front panel centred on the position of the dial drive shaft. This will allow the panel to be temporarily mounted with the drive shaft protruding through the centre. The backing plate may now be adjusted to sit flat against the rear of the front panel, the position of the tuning capacitor being adjusted, if necessary, to achieve this. Finally, square the backing plate with the front panel and mark the dial mounting holes through the holes of the backing plate.

Remove the front panel and drill the four holes as marked, then reassemble the chassis and front panel. The backing plate remains behind the front panel in the finished assembly and the card, plastic cover and cursor are mounted on the front, the four mounting screws making a rigid assembly. The tuning capacitor in our prototype was raised above the printed wiring board about 1/8in by using two brass washers under each mounting-bracket hole. This allows a little adjustment should the clearance hole in the front panel be initially out of alignment with the vernier drive shaft.

For those readers who wish to make their own metalwork, a blueprint will be available through the information service as also will be a calibrated dial card. The charge for these items will be 50c (5/) and 20c (2/) respectively.

The band selecting switch requires two wafers, each of the three pole, three position type. Ideally, to facilitate wiring, these two wafers should be double spaced, and such a switch would doubtless be available to special order. However, we found it little dearer, and a good deal more convenient, to purchase a three wafer version, which is a stock item, and remove the centre wafer.

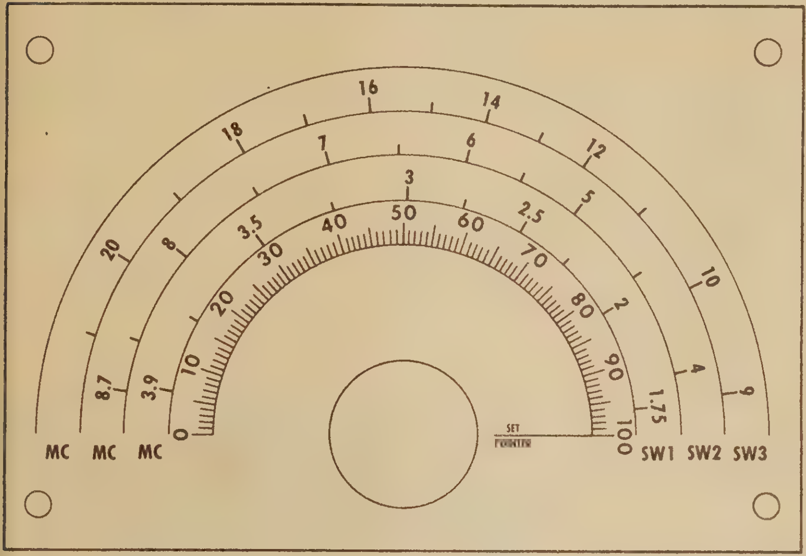
There is very little wiring involved in the converter, the greater portion being in the printed wiring board. However, make sure that the three conductor mains flex is secured to the chassis with a clamp. This will stop accidental breakage of conductors should someone trip over the power cord.

To align the converter it is necessary to have access to a signal generator or modulated oscillator. Standard alignment techniques are used, the slugs of the coils being adjusted at the low end of the tuning range and the trimmers at the high end of the range. When adjusting the aerial trimmers some interaction may be evident with the oscillator. If this occurs, peak the aerial trimmer for maximum output while shifting the signal generator to keep the signal in tune. It will now be necessary to retune the oscillator trimmer to make the dial reading correct. This procedure may have to be repeated several times until the maximum output is achieved at the correct dial setting.

Instructions on how to align superhet receivers are available through the information service for 20c (2/) each and the same instructions apply to the alignment of our converter.

For those fortunate enough to own a Grid Dip Oscillator or Resonance Meter, these instruments may be used for preliminary alignment of the coils in the converter. If a resonance meter is used care should be taken to keep the leads between the meter and the tuned circuits as short as possible.

While our converter has its own built-in power supply, there is no reason why an existing power supply may not be used. An external supply would be required to furnish approximately 250 volts at 16 milliamperes and 6.3 volts at 450 milliamperes. ■



This is a full size reproduction of the dial scale. Copies on glossy paper are available through the query service. Note the "Pointer Set" marking, corresponding to the gang fully closed.

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The practical help you get with Kodak tape by no means ends with back-printing. If you've ever had the pleasure of using the Kodak Thread-Easy Reel, you'll know what we mean. Here's a reel that takes the fumbling out of tape handling. You simply drop the end of the tape in the slot and you're ready to go. The reel's smooth surfaces, bevelled edges, and dynamic balance treat the tape kindly. And each reel has a built-in splicing jig, index scale, and matte writing-surface on each side.

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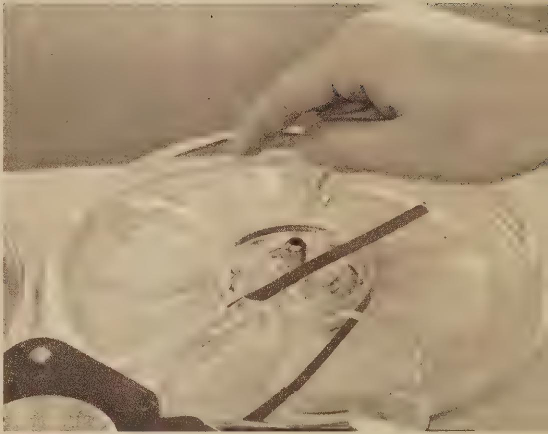

(a) The Thread-Easy Reel in use

(b) Tape showing back-printing

(c) The splicing jig

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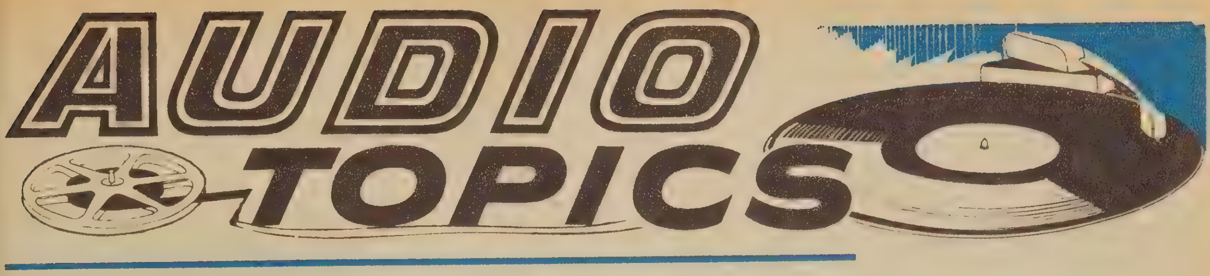

AUDIO TOPICS

AUTOMATIC RECORD CHANGER PRODUCTION TECHNIQUES

To many people automation suggests intricate machines executing the most complicated operations. Yet for many years a large number of homes have installed in a radiogram or record player one of the first examples of automation: an automatic record changer. This article gives interesting insight into the production of these units.

By E. W. Mortimer, Garrard Engineering Ltd.

The automatic record changer dates from around 1930 and was invented to save the listener from having to leave his chair every two or three minutes to change a record. Records were played at only one speed, 78rpm, and with the relatively coarse groove used, the longest uninterrupted playing time available was about five minutes.

Since 1930 the art of recording and reproduction from gramophone records has changed so much that it has revolutionised the whole concept of record changer design and production. The modern record changer is a precision instrument, and this article describes some of the intricate operations used in its manufacture to provide the means for achieving the high standard of sound reproduction which is expected today.

What does a record changer have to do? It must be able to rotate records at any one of four speeds, 16-2/3, 33-1/3, 45 or 78rpm. It must handle three record sizes 7in, 10in or 12in, and be able to sense which diameter record is to be played so that the pickup can lower in the correct place. It must know when the end of the record has been reached so that the pickup can rise and move away to allow the next record to drop and be played. It must also be able to tell when the last record has played so that it can switch itself off.

In addition it should be able to play single records manually and have facilities for rejecting the record being played.

The mechanical handling of gramophone records in order to play a number of them consecutively, while being the basis of the automatic record changer, is not the principal criterion for the assessment of its quality. This is based on the fidelity of the sound given by the complete reproducing system, the record changer being an important component.

Among the many factors affecting the quality of the reproduction obtained from gramophone records, the three principal ones are known as wow, flutter and rumble, all of which are inherent to some degree in every rotating mechanical device used for sound recording and reproduction.

Wow is the term used to describe speed variations superimposed on the reproduction below 20 cycles per second, and flutter above 20 cycles per second. Rumble is random unwanted noise below 500 cycles per second. These three factors originate in the mechanism used to rotate the record and, to reduce them to a practical minimum on a quantity production basis, calls for highly specialised engineering techniques.

The high degree of amplification used between the pickup and speaker will reproduce the slightest bearing noise as rumble and any imperfections in the driving system as wow and flutter. For example, a journal or thrust being normally considered good engineering practice would be too noisy in a mechanism used for sound reproducing purposes, and the electric motors used to drive the mechanism and turntables have to be made to much higher standards than would be required for purposes other than for the reproduction of sound.

A record changer assembly line at Garrard's Australian plant at Villawood, N.S.W. Garrard Engineering Company is a member of the Plessey Components Group in Australia.

The first essential, therefore, is to make sure that all bearings are perfectly free with the minimum clearance and run with the minimum of noise or vibration. Whenever possible oil impregnated sintered bronze bearings are used, as these show little signs of wear over long periods of use and rarely need lubrication.

The bearings need to be specially processed to meet the standard required. The bearing holes are accurately sized and finished by rotary burnishing and the self-aligning bearings as used in the electric motors are also spherically turned on the outside to make sure that the hole is true with the bearing location.

Shafts which run in these bearings are specially finished, most of the turntable spindles and all rotor shafts being hardened, tempered, ground, lapped and superfinished to a smoothness of one micro inch or better.

The clearance between the spindle and bearing bore must be very small to avoid noise which would show itself as rumble. The maximum clearance allowable in the bearings of the electric motor is ± .0001in and every motor is run continuously for three hours on a running rack to bed in the bearings to make sure that the shaft rotates freely, before being tested and assembled to a record changer.

Special precautions are taken in the

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Inputs: (per channel)	
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Tape Recorder:	*300K ohm at 1.2V for 10 watt output*
Radio:	*220K ohm at 150mV for 10 watt output*
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Crosstalk Attenuation:	*Better than 60 db, 50-15,000 cps, at maximum output*
Harmonic Distortion:	*Better than 0.5% for 10 watts output at 1 kc/s.*
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manufacture of the component parts of the turntable driving system to avoid possible rejection after assembly. The inside rim of the turntable is driven by a rubber intermediate wheel which in turn is driven by the motor pulley. The position of the rubber wheel and the angle of its tension spring must be carefully chosen so that the rubber wheel wedges just sufficiently between the motor pulley and turntable rim to drive without any trace of slip, out it must not wedge enough to cause undue loss of power and, incidentally, increase rumble.

Should the motor pulley run more han .0002in out of true on any of its four steps it will cause flutter on the appropriate speed. As this pulley must be nterchangeable to accommodate for differences in motor speed on various supply frequencies the required accuracy of the fit on the motor shaft is achieved by the use of special boring and turning machines developed for the ourpose.

The bore of the pulley is blind due o the fact that the step diameter for he speed of 16-2/3 is smaller than that of the motor shaft on which the pulley its.

To give an accurately sized and arallel hole in the pulley it is bored to n accuracy of .0001in but because of the ery close tolerances a small slot has o be broached along the length of the ore to allow the air to escape so that e pulley can be assembled to the motor haft.

All four pulley steps are finish turned y driving the pulley on a stationary rbor by means of a rubber wheel. Vhen finished, the pulley is locked on e motor shaft by two diametrically pposite screws which must be equally ghtened to maintain the true running f the pulley.

The periphery of the rubber internediate wheel is ground and then checkd for truth and consistency of the relience of the rubber on a specially eveloped electronic instrument. This atter check was found to be necessary o reject wheels having soft or hard ections in the rubber which can cause ow and rumble.

The final link in the driving system the inside of the turntable rim, which ust be round and true. Most record hangers have pressed steel turntables nd as it is not practical to machine e rim to provide a perfectly true driv- g surface, great care is taken in the forming of the rim to make sure it is round and the turntable is then held in an accurate centralising chuck for piercing the centre hole to ensure truth.

On assembly, a lot of attention is given to ensuring that all driving and driven surfaces are parallel to each other. For example, should the rubber intermediate wheel or motor pulley be slightly out of square it would cause what is known as scrubbing, which would be reproduced as flutter.

At right: Final tests of completed record changers being carried out at the Garrard plant at Villawood, N.S.W. The tests include checks of pickup output and phasing, rumble, wow and flutter.

Illustrated, below, the Garrard Model AT60 automatic record changer.

The electric motor used to drive the record changer can be a prolific source of trouble if certain precautions are not taken in its manufacture. It must run smoothly without hum, vibration, mechanical noise, and have the minimum external magnetic field. It must also be robust and capable of running for long periods without the need for frequent lubrication, and even though it may be enclosed in an unventilated cabinet, no overheating should occur.

The smooth running of the motor is achieved by attention to the finish of the rotor shaft and bore of the bearings as already described. Hum is avoided by making sure that the stator coils are, in the case of a four pole motor, electrically in balance and that the rotor is exactly in the centre of the stator bore, this being one reason for spherical turning of the outside of the bearings as previously mentioned. In addition all rivet and location holes in the motor laminations and bearing covers are held to very close tolerances.

Motor vibration, which can be the main cause of rumble, depends upon the true running of the rotor shaft and the balance of the complete rotor assembly. The rotors are assembled on to the superfinished shafts which are then stress relieved. The outside diameter of the rotor is ground to size on an automatic ma-

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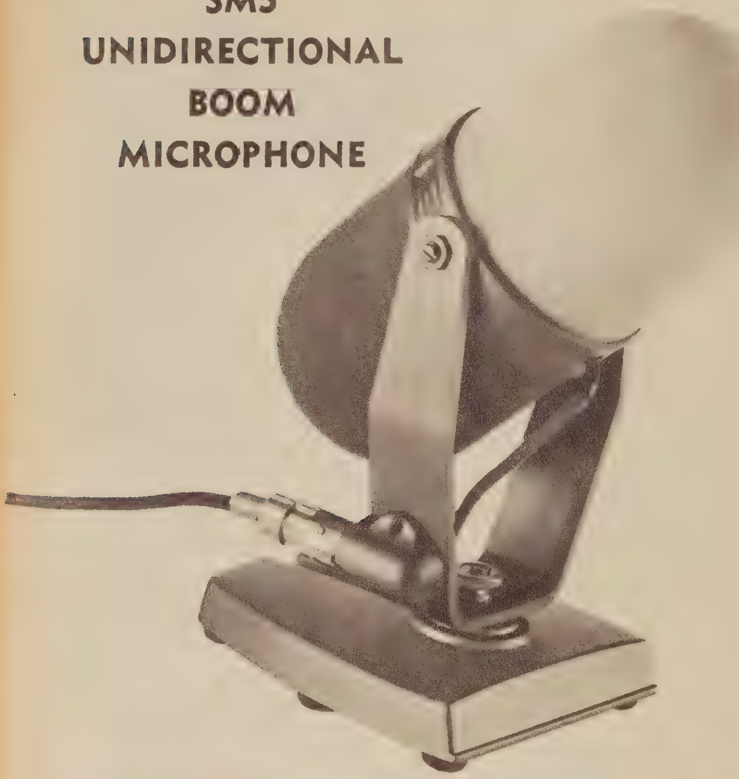

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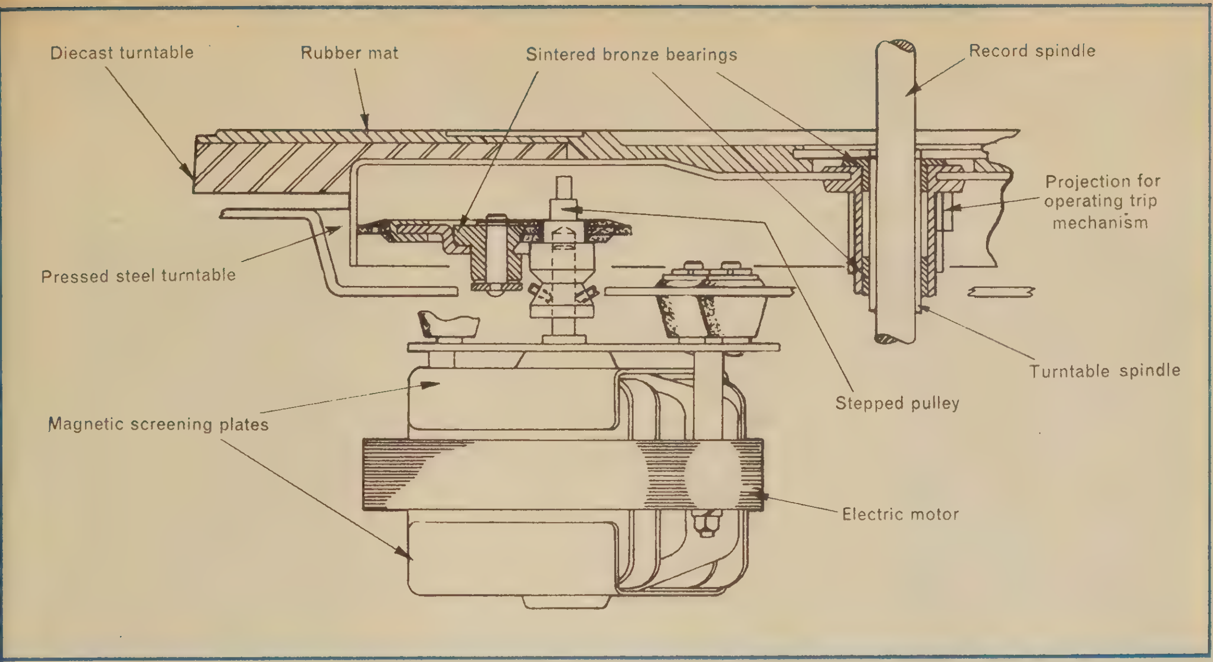
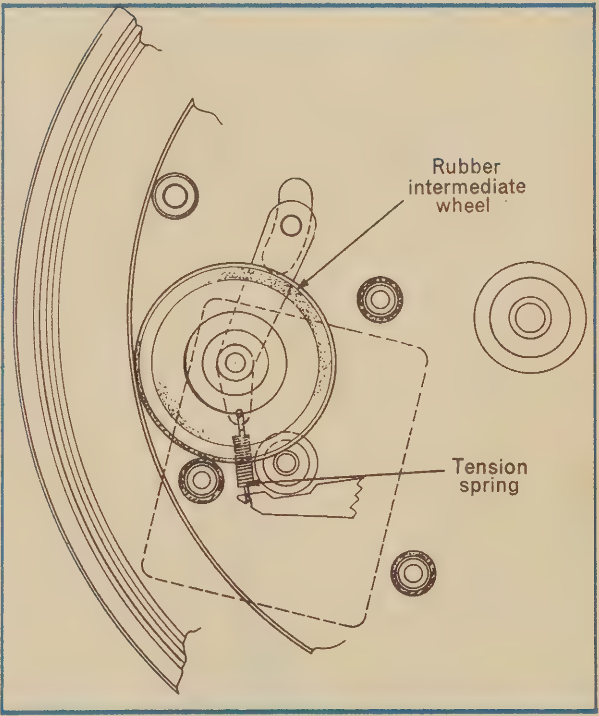


Side elevation diagram of the turntable four-speed drive mechanism.



Plan diagram of the turntable drive mechanism. The intermediate wheel must be of even texture and absolutely true in dimensions.

chine and given a thin even coating of lacquer to prevent rusting. From experience, especially in the export markets, it has been found necessary to give special attention to what appears to be a simple operation, and the procedure adopted for lacquering rotors is worth describing.

After grinding, the rotor assemblies are fed on to a ramp which conveys the rotors through an electric oven having a controlled temperature. This drives off all traces of moisture or flux which may be trapped between the riveted laminations. The rotors, while still warm, are rolled over a ramp through a controlled depth of lacquer and passed through another drying oven to bake the lacquer.

The rotor assemblies are then checked for tightness of the shaft in the rotor by applying an end pressure of 250lbs in an air operated jig which also checks that the position of the rotor on the shaft is correct. The shaft is then checked for truth by rotating the assembly on its normal bearing locations and clocking the shaft at the point where the pulley will be fitted.

The rotor assembly is now ready for balancing, the accuracy of which is one of the main factors governing the final performance of the motor, especially in the reduction of flutter and rumble.

The rotors, which are dynamically balanced to an accuracy better than .031cm.gms on the latest type of automatic balancing machine, are fed into a magazine and are picked up one at a time by an arm which grips the rotor with the aid of a suction cup and places it on "V" bearings where it is revolved by means of a rotating magnetic field.

The amount and location of any out-of-balance is registered by the machine. The magnetic field is then switched off and the rotor is picked up by the arm, placed on a fixture and, if required, recesses are drilled in the copper end plates at points previously registered by the machine to correct the balance of the rotor. A further position on the machine finally checks the rotor. If it is within the pre-set limits for balance, it is passed; if outside the required limits it is rejected.

All the principal shafts on a record changer run vertically and the thrust bearings on two of them, those for the turntable and rotor, can be a source of rumble. To avoid this the ends of the

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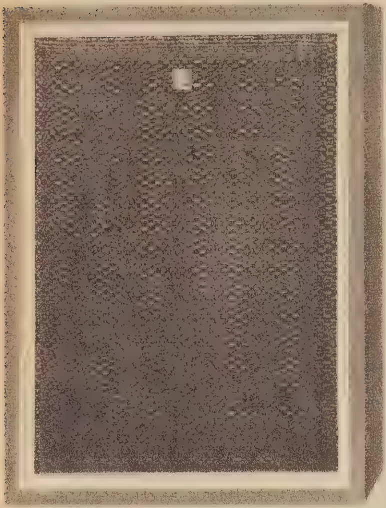
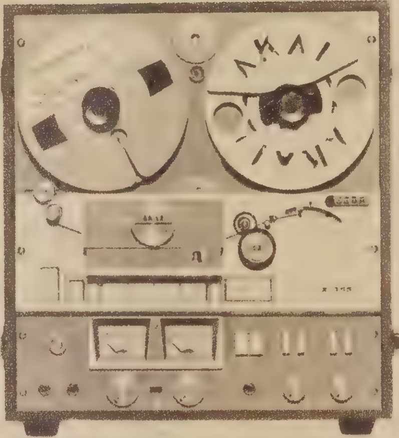
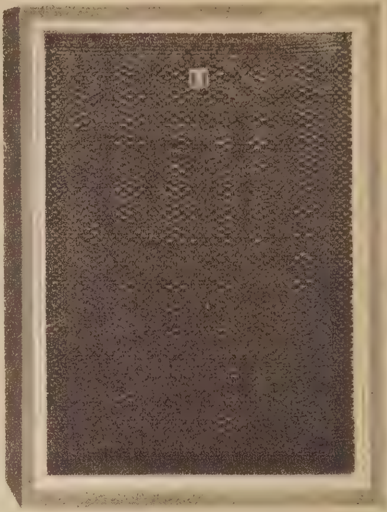


MODEL SW—130



MODEL *X-* 355



MODEL SW—130

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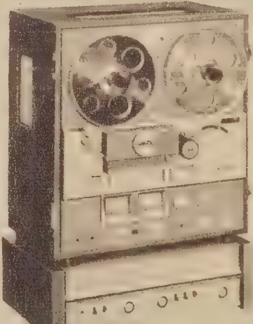
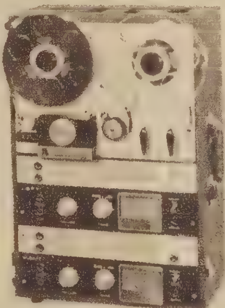


MODEL *X-355D*
MODEL AA-5000



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tor shaft are lapped to a high finish o that when running on its ball thrust e minimum of friction and noise is enerated.

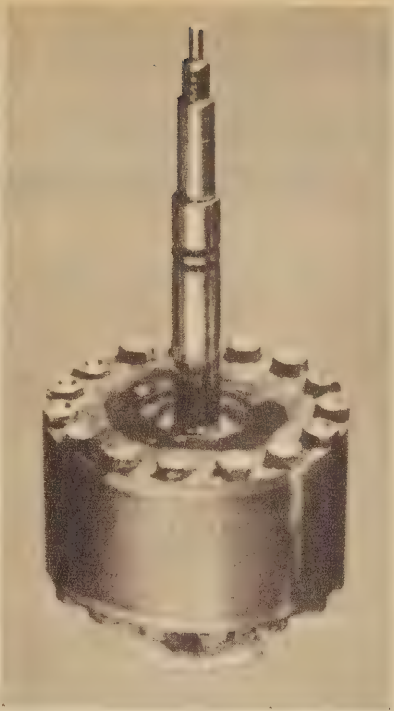
As a stationary record spindle passes rough the centre of the turntable pindle a ball race must be used to arry the weight of the turntable. A ormal commercial type of thrust ball ace would be too noisy, consequently pecially made ones with five steel balls a plastic cage between two hardened nd lapped steel washers are used. The omplete ball race assembly rests on a silient plastic washer to cushion the eight of the rotating turntable from the ody of the changer.

In addition to the various techniques eveloped and used in the production of omponents for the turntable driving stem some of those used to produce the echanism are also of interest.

The first requirement in the automatic andling of records is for the record hanger to drop them individually on to e turntable for playing. This is achie- ed by means of a stepped record spindle corporating a lever operated by the cord changer mechanism to push the cords off the step one at a time.

There are many types of such spindles, e example described being one of the ost popular and is the type used in e record changer illustrated.

The body of the spindle is stainless eel and four milling operations are re- uired to produce the step and slots for e pushing lever and latch. The use of ainless steel was found necessary in rder to withstand the abrasive action used by records dropping and revolv- g around the spindle. Over a period time this abrasive effect is sufficient remove any plated finish.



A motor rotor with steps machined on the shaft to provide the four desired speeds. The rotor has been balanced by drilling for a short distance into the ends of some of the rods.

Every changer is checked for correctness of the following functions, not necessarily in the order given.

1 Dropping one at a time, a stack of mixed 7in, 10in and 12in records.
2 Operation of record size selector mechanism.
3 Switching off after last record has played.
4 Height of pickup lift, adjust if necessary.
5 Lowering position of the pickup using special test record giving correct landing radii.
6 Operation of automatic trip when pickup reaches end of record.
7 Stylus pressure, adjust if necessary.
8 Operation of pickup muting switch, if fitted.
9 Effectiveness of switch click suppressor.
10 Lateral and vertical freedom of pickup arm.
11 Correct operation of speed change control; check that intermediate wheel is in the centre of the appropriate motor pulley step.
12 Use special stroboscopic disc to check that, while the pickup is playing a record, all four speeds are within plus or minus 2 per cent of nominal.
13 Operation of "off" "manual" and "auto" control.
14 Operation of pickup arm bias compensator if fitted.
15 Angular location of record spindle.
16 Satisfactory operation when using large record spindle for dropping 7in records having 1½in diameter centre hole.
17 Absence of overall mechanical noise.
18 Satisfactory operation on 10 per cent below minimum rated voltage.
19 Motor current consumption.
20 Phasing of stereo pickup connection.
21 Angular position and freedom of record overarm.
22 Cartridge output if mono, and output and channel separation if stereo.
23 Insulation between motor and pickup circuits and frame of changer.
24 Check setting of links in voltage changeover terminal block, and that marking on motor corresponds to its voltage and rating.
25 Finish and completeness.

The spindle assembly must be free om all traces of burr and these are re- oved from the spindle by brushing, and om the pushing lever and latches by to-finishing. This latter process is used r removing burrs and sharp edges from practically all levers used on record changers. The parts are placed in a drum with mineral chippings and water and are vibrated or tumbled for a given period. The method, size of chipping and time depends upon the shape of the levers and material from which they are manufactured.

The dimensional limits for the record spindle have to be closely held so that a record on top limit for thickness will not jam and two will not drop together should they be on bottom limit.

The most vital and sensitive mechanism on a record changer is the automatic trip. This operates when the pickup reaches the end of a record and engages the mechanism to complete one cycle. The mechanism used is known as the velocity type of automatic trip.

As the pickup approaches the end of playing a record a lever underneath is pushed inward by the pickup arm. This lever, which has a friction pivot, intermittently engages with a projection on the revolving turntable hub. While the pickup slowly moves inward, as it does while playing a record, the projection as it revolves pushes the lever away from it. However, when the pickup reaches the run-out groove at the end of a record it moves the lever inward too far to be pushed away by the projection which then positively engages with it; this action causes the mechanism to engage and complete one changing cycle.

The reliable operation of the trip is the basis of the whole mechanical performance of the changer and it must be sensitive enough to operate on a pickup acceleration over 1/16in within one revolution of the turntable. The action of pushing the lever away must be so light that it cannot be heard via the pickup and the maximum side pressure which can be tolerated on the pickup arm to operate the trip is about 0.25gram. It also has to cover a wide operating radius to accommodate all the types and sizes of records now available.

To achieve all this the associated levers must be free from burr so that they move freely, and special lubricants are used, as ordinary oil would congeal and prevent operation. Clean and careful assembly is absolutely essential.

The final testing of Garrard record changers calls for special instrumentation and most of the equipment used has been developed and made in Garrard's own electrical laboratory.

Every changer is checked for correctness of all electrical and operational functions. Among the tests given are those for wow, flutter and rumble, all of which require the use of special test records and sensitive instruments. In addition there are 25 operational functions to be checked on each record changer and the failure to any one will cause it to be rejected.

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Classical reviews

By JULIAN RUSSELL

The Genius of Alfred Cortot

CHOPIN—Twenty-Four Preludes, Opus 28; Prelude in C Sharp Minor, Opus 45; Four Impromptus. Alfred Cortot (piano). World Record Club Connoisseur Series, Mono CE/3033.

Alfred Cortot was more than the pianist remembered by most musicians today. True he was a fine executant; one of the greatest of his day especially in the playing of Chopin and music of the French school, though he was never limited to one style. I remember well his Schumann, his Schubert—in inimitable performances with Thibaud and Casals — and his Falla, among other composers.

He was also a respected orchestral conductor and once spent three years at that stronghold of everything that's German, Bayreuth, as chorus master. Alongside these activities he found time to write a definitive two-volume work on French piano music which, to the best of my knowledge, has never been translated into English and would be of immense value to students all over the world if it were.

It is not generally known that at the age of 24 he conducted the first performance in Paris of Wagner's "Gotterdammerung" and first won recognition as a pianist, not in Chopin, Schumann or Debussy, but as an interpreter of Beethoven's Piano Concertos. But it is in the works of Chopin that he will be remembered and this disc offers him, if not quite at his greatest, at any rate very close to it.

Cortot, was, despite his greatness, not always note perfect. Nor, for that matter, was Artur Schnabel, who was sometimes called by detractors a "biblical" pianist — one who never let his right hand know what his left hand was doing. There are blemishes on this disc under review, but the occasional wrong note should worry no one. As a famous pianist once remarked to me: "I would rather hear Cortot play it wrongly than many of his rivals play it correctly."

The important features in all the pieces listed here are their lineaments. The shape is always elegant despite a thought more rubato than is fashionable nowadays. Cortot's touch has just the right pearly quality to suit the compositions. Yet despite the sensitivity of his readings they are never effeminate. They are firmly skeletoned and supply articulated. It is important to mention, too, that the original 78s have been transferred to LP so that there is practically no surface noise, while at the same time the original quality of the piano tone has been preserved.

. . . *And now Rachmaninov's Prelude in C Sharp Minor and all that Jazz!*

* * *

TELEMANN—Suite in C Major. Moscow Chamber Archestra conducted by Rudolph Barshai; Concerto in B Flat Major for Three Oboes, Three Violins and Basso Continuo. Pierre Pierlot, Eugenei Nepalov, Piotr Dubrov (oboes): Rudolf Barshai, Andrei Abramenkov, Leonid Polees (violins): Concerto in F Minor for Oboe and Strings. Eugenei Nepalov (oboe) and Moscow Chamber Orchestra conducted by Rudolf Barshai. HMV Stereo OASD631.

Not so long ago, baroque music came close to being completely neglected. Bach and Handel were played and admired for many reasons, not all of them valid, but other composers of the period, especially the German ones, were very seldom heard. Such has been the extent of the recent reversal of the swing that Baroque might easily become neglected again, so avidly is anything of the period consumed.

A composer of considerable stature, and one whose music rarely fails to be expressive (an exception to much of the eighteenth-century music that is nowadays, whatever its quality, rapturously received) was Georg Phillipp Telemann, a contemporary of Bach and Handel — he was, in fact, godfather to Carl Philip Emanuel Bach. Telemann's music was held in the very highest estee during his lifetime, but was interr with him when he died, only to triumphantly resurrected a very fe years ago.

He is represented here by three piece all of them typical of the high polish his craftsmanship and all of them, me, a delight. (It is interesting to co sult the English LP catalogue and noti that before 1960, Telemann recordin were as rare as any minor composer yet today their titles fill nearly a pa and a half.)

If any record could be calculated raise Telemann's music in the estee of those to whom he is only a name a musical text book, it is this disc playe with the utmost refinement and authe ticity of style by this Russian orchest under Barshai. And, if you are like m you will be astonished at the originalit and resource of the scoring in whic oboes produce sounds that might we be applauded in Darmstadt today.

All three works are enchanting to m but my favourite, in what to a respo sive listener must be a Judgement Paris, is the concerto for three oboes an three violins. This combines playin of the very highest order with inventio of apparently inexhaustible fertility. B I have picked this out for special me tion simply as a personal preferenc You may well like one of the other tw even more, or even all three equally. any case, here is a disc that I can highl recommend, not only to those alread sold on Telemann's music, but to thos who till now have never heard a no of it.

* * *

STRAVINSKY — Apollo (Apollo Musagetes). Ballet in Two Scene Orpheus. Ballet in Three Scene Columbia Symphony Orchestra co ducted by Igor Stravinsky. CB Stereo SBR235135.

In the first recording of any conse quence made of Apollo, or as it w then, Apollon Musagetes, by Anserm on an old Decca mono, that conduct used a "white" tone in his strings th went well with the Balanchine ballet I remembered it. But during the pa four years I have heard Stravinsky co duct the work twice, once in a theat with the New York City Ballet (in Ham burg) and once in a concert hall. An both times he drew from his strings th full rich tone you hear on this disc.

There is therefore no doubt in m mind that this is the sound Stravinsk wants, and have come right round to h way of thinking. This is a beautif performance, its 18th-century ancest stressed by the cleanness of the dotte rhythms, the tone richly varied but a ways lustrous. The engineer has seen it that the polyphonic structure is alwa clearly and immediately perceptible the ear without use of a score.

Apollo is, generally speaking, a seren work, and Orpheus, too, has its momen of wonderful tranquility. But in th latter you hear many violent interru tions to accompany its more dramat events. It, too, by the way, was com posed for a Balanchine ballet. Th music is for the most part lean an muscular, the scoring for smallish orch estra that of a master and very muc in Stravinsky's own colourful style, usin the woodwind as a sort of vinaigret dressing for the string salad. If you a an enthusiast for Stravinsky of th middle period, this is certainly for you.

BACH—Concerto in D Minor for Clavier and Orchestra (BWV 1052).
CHOPIN — Piano Concerto No. 2 in F Minor, Op. 21. Vladimir Ashkenazy and the London Symphony Orchestra conducted by David Zinman. Decca Stereo SXL6174.

Here is a disc in which soloist and orchestra share honours equally in works of very different character. The Bach is sturdy in rhythm, sparkling in atmosphere and nuanced in a manner eminently suited to its style. Precision is a paramount consideration and here you will never hear a falter or an untidy attack. And the rhythm bounces quite without strutting.

I have a minor criticism to make. In the second movement there is occasional disagreement between pianist and orchestra about the length of appoggiaturas, but this does little harm, so affectionately and expressively is the whole enterprise undertaken. And, as if to reassure one, the finale pours out its sunshine with the utmost generosity and a perfection of balance that is unassailable.

Ashkenazy has long been one of the finest Chopin players recording, so that the Second Piano Concerto, as played here, comes as no surprise. It only serves, in its poetry and digital fluency, to endorse previous opinion expressed in this column. If you want to try out the highlights, listen to the shining freshness of the orchestra in the long introduction, which is usually made to sound so uninteresting. And Zinman sustains this interest in the orchestral part throughout the whole of the concerto despite the strong counter-spell of Ashkenazy's playing.

Nor will you be hearing, either from soloist or conducter, a reading that you can take for granted. If you are used to the usual manner of taking the opening bars the energy with which they are presented here will astonish you. I heard Zinmann in Amsterdam in July last year and was then impressed by this young pupil of Monteux, who is not yet 30. This lovely disc more than confirms my enthusiasm.

* * *

POULENC — Stabat Mater. Regine Crespin (soprano) and the Rene Duclos Choir and the Paris Conservatoire Orchestra conducted by Georges Pretre.
Four Penetential Motets. Rene Duclos Choir conducted by Georges Pretre. Record Society Stereo S/6175.

Poulenc, for many years cited as an example of French frivolity and the very latest in musical chic, assumes a different mantle altogether when writing sacred music. And it is worthy of note that he invariably writes more seriously for the voice than for other media. Some of his songs are, of course, sugary. But I had in mind his fine opera, "Les Dialogues des Carmelites," with its splendidly understated drama, and "Les Mamelles de Tiresias," which, despite its title and libretto, offers much to admire seriously.

The two choral works in this disc, issued at a club price, are both beautiful in their own particular way, yet share some points in common. Both are deeply reverent while avoiding boring piety and both pay graceful tribute to some of Poulenc's earlier musical compatriots. While in the Stabat Mater both Gounod and Faure have obviously,

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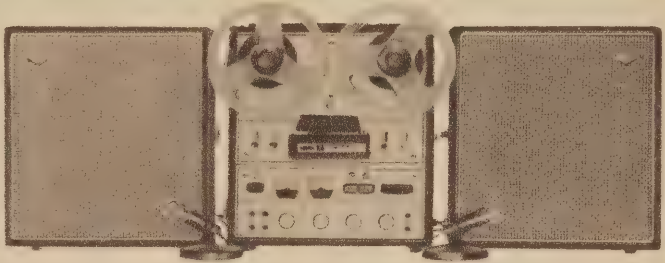

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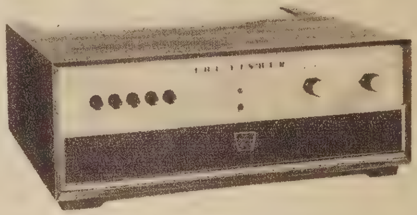

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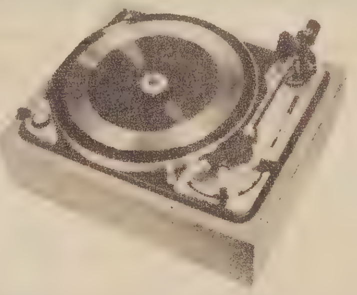

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hough not surprisingly influenced Pouenc in the "Four Motets," he reverts ack to the fourteenth-century style of achaut and his Renaissance followers.

For as long as I can remember, a tabat Mater has always recalled nemories first of Rossini, next of vorak. Though dozens of others have een composed, they all seem to have allen out of the general twentieth-entury repertoire. The Poulenc is vorthy of inclusion for many years to ome. It is alternately gravely sweet, ompassionate, limpidly serene and lashingly dramatic.

It is the kind of music the Rene uclos singers nearly always present dmirably, as they do here. And the olo soprano, Regine Crespin, is at her est in this maternal type of role. I eard her, by the way, give an outtandingly vivid performance of the arschallin in "Rosenkavalier" in Paris n 1962. Her control of legato is lways impressively steady, her attack earless and accurate, her range more han adequate.

I did find, however, one serious fault hroughout the whole performance, with Madame Crespin as culpable as the hoir. The diction everywhere is so lovenly that I, for one, was unable to uess the language being used for much f the time.

Even in the Four Motets, which are ung "a capella" (unaccompanied), there s no improvement in the diction, though he actual singing, divorced from this eature, is always sensitively moving. The four pieces are more sternly coneived than the "Stabat Mater." A deep ense of penitence is expressed throughut. They sometimes explode into ehemence strange to encounter in oulenc's music. But they remain ravely, sombrely beautiful.

So little music of this kind is recorded owadays, or at any rate is available in English-speaking countries, that this disc hould receive a warm welcome, espeially at the price at which it can be ought.

* * *

SCHUMANN — Symphony No. 1 in B Flat Major, Op. 38 (Spring); Symphony No. 4 in D Minor, Op. 120. London Symphony Orchestra conducted by Josef Krips. World Record Club Stereo T/4050.

This performance was put out on nono some five years ago. Now it omes on stereo, excellently clear and venly distributed, with a dynamic ange suited to the non-epic character f these symphonies. It remains my avourite performance. Krips offers o heavy-handed romanticism, but deliate and precise playing. This delivery loes much in the first movement of the irst symphony to provide something to dmire against what, as a purely subective response, might be a tempo a ittle too tightly reined in to please ll tastes.

I found the rest of the speeds in the arious movements those one might expect to hear in a performance that akes a sane view of every bar. There s, by the way, no question of the valid ase Krips makes out for his tempo n the first movement.

The same thing happens in the first novement of the Fourth, where again the tempo is held back in a manner that might surprise some at first hearing. And again the rest of the work should win unqualified approval in all quarters. The only quibble I have to make about the engineering is that the timpani are often recorded a shade too modestly.

* * *

SAINT-SAENS—Piano Concerto No. 2 in G Minor, Op. 22. Piano Concerto No. 4 in C Minor, Op. 44. Philippe Entremont and the Philadelphia Orchestra conducted by Eugene Ormandy. CBS Stereo SBR235143.

There was a time, not so long ago, when Philippe Entremont was a brilliant but unstable player. His formidable technique was frequently blemished by bosh shots. But his elan went far to atone for his faults. And there was something zestfully youthful in all that he did.

This new disc announces a maturity that will be welcome to his many admirers. Neither concerto demands profundity; both are elegant and ask of the listener nothing but relaxation to enjoy their many felicities. The main change in Entremont's style has been the abandonment of the effusion which was an important feature. Now his style has become more classical in outlook and less prodigal of brio.

Yet even in the fast movements he shows that his technique is as brilliant as ever, his touch in turn crystalline or forceful without harshness. And he can express unsentimentalised lyricism in a manner I find as convincing as it is enjoyable.

Entremont is well served by the Philadelphia under Ormandy who can, when necessary, provide some of the most luscious sound imaginable, or match delicacy with that of the soloist. The engineer has provided a satisfactory balance throughout.

That the piano tone has the customary American sharpness is not out of place here, where the composer had in mind a French instrument with a lighter tone than its German counterparts. Importantly the tone never becomes brittle but remains luminous and of beguiling clarity. I do not expect either the works or the performances to appeal strongly to those with strong Central European tastes. But to others they should provide very attractive entertainment indeed.

* * *

ADAM—Giselle (Ballet Suite). Paris Conservatoire Orchestra conducted by Jean Martinon. World Record Club Stereo S/T4051.

The feature that appeals to me as much as any in this amiable recording is the way Martinon keeps the music moving without sentimental lingering over the juicy bits. Not that he cannot broaden his phrasing when necessary. He can—and does. There is never any suggestion of hurrying through the ballet. But he does make it sound as if it were written to accompany dancing, a fact sometimes forgotten by other non-ballet conductors.

The playing is polished, but without too high a gloss. It is all very easy to listen to and might well provide pleasure to other than ballet fans.

HAYDN — Symphony No. 88 in G Major; Symphony No. 104 in D Major (London). New Philharmonia Orchestra conducted by Otto Klemperer. Columbia Stereo SAX-02571.

These performances are likely to appeal to most of those listeners who might find the Saint-Saens noticed above, flippant and frothy. Tempos are indubitably correct, phrasing and shading compelling of admiration in every bar. Lacking, however, is sparkle, especially the kind of sparkle that the late Beecham knew so well (sometimes) how to add to this delightful music.

That Klemperer's tempos are occasionally on the slow side will surprise no one. That the playing is consistently fine-grained is also to be expected from this conductor and orchestra. But a spice of adventure would have made these two symphonies, at any rate to this listener, much more enjoyable.

* * *

CHOPIN — Piano Sonata No. 2 in B Flat Minor, Op. 35 (Funeral March); Piano Sonata No. 3 in B Minor, Op. 58. Samson Francois. Columbia, Stereo SAXO7527.

I cannot recommend very much about this disc. In the first place, I do not like the recorded tone of Francois' piano. Most French pianos are lighter in tone than German, English or American instruments. But here the tone is positively spiky and unsuited to the program played.

Although Francois is today very popular in France his style has always irritated me. It is flabby in its use of exaggerated rubatos, its changes of tempo are unpredictable and inconsiderate of the composer's intentions, and gusts of emotion further distort the natural shape of much of what he plays.

In fairness, I must add that there are long passages that sound satisfactorily poetic but they do not occur frequently enough to qualify anything I have writen before. It never ceases to puzzle me how a nation that could revere Cortot will fill French concert halls whenever Francois gives a recital.

Recommended

Beniamino Gigli — Arias and Duets, Volumes 1 and 2. Most of these were recorded during the 1940s but sound well on L.P. H.M.V. Great Recordings of the Century. Mono. COLH-143/4. They can be bought separately.

Elisabeth Schumann — Aria and Song Recital. Most of these were recorded in the late 1920s and have been transferred with reasonable success to L.P. Some have orchestral accompaniments, some piano. Madam Schumann's style is exemplary. H.M.V. Great Recordings of the Century. Mono. COLH-154.

Franco Corelli sings Great Religious Arias. Many of these will be well known to listeners. H.M.V. Stereo OASD599.

J. S. Bach. The Art of Fugue. The Fine Arts Quartet and the New York Woodwind Quintet. Record Society S/6177-1/2.

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DOCUMENTARY RECORDS

Reviewed by Ellis Blain

YEATS' NOH PLAYS "At the Hawk's Well" and "The Dreaming Of The Bones." Argo ZRG 5468. Also "The Cat And The Moon" and "Resurrection" Argo ZRG 5469. Both Stereo.

All these plays stem from the great Irish poet and dramatist's interest in Japanese art, particularly the "noh" play for dancers but the whole feel and characterisation is Irish through and through.

In writing the plays, Yeats sought to convey his meaning by "calling to the eye of the mind," as he puts it. He deliberately stylised and limited his actors' movements and used masks. The plays were intended to be presented to small audiences in drawing-rooms. These factors make them ideal material for the medium of the long-playing gramophone record and nothing has been spared in production or presentation that would help to make these first recordings definitive for a long time to come.

The actual recordings were made at Silverpine in Dublin and the quite considerable cast includes several of the outstanding actors in contemporary Irish theatre, among them Daphne Carroll, Eamonn Keane, Arthur O'Sullivan and Ronnie Walsh. Special music composed by Gerard Victory is performed by a Quintet of fine instrumentalists playing flute, clarinet, piano, bass clarinet and percussion.

> *"It is clear from their murals that music was a passion with the Etruscans. They cooked to music; boxed to music and, sad to say, even beat their slaves to music. They are credited with the invention of the trumpet, and the fame of the Etruscan flautists reached far beyond the borders of their own land."*
>
> *(June Grimble speaking in B.B.C. "Woman's Hour.")*

Even the album design is characteristic and remarkable in that it features the original masks designed by Dulac for the first performance of "At The Hawk's Well." Yeats himself was so fascinated by these masks that he contemplated writing further plays around them. Finally, the notes by Noel MacMahon are evocative but, regrettably, rather too brief when one is breaking ground which, inevitably, must be fresh to most of us. I would have liked to see a small booklet giving more of the background to the plays and Yeats' own attitude to them, as well as some exposition of the degree to which "noh" actually enters into the final construction.

One other aspect of the reproduction is of considerable interest and historical importance, namely that the producer has seen fit deliberately to limit the traditional intoning speech required by Yeats. In my opinion, this was not only desirable but necessary. It is well established that few artists are definitive performers of their own material, although there are exceptions. One has only to turn to another Argo record, "William Butler Yeats" (RG182) and listen to a 1932 reproduction of the author himself giving his reasons for preferring this kind of performance and intoning his own famous poem, "The Lake Isle Of Innisfree," to appreciate how destructive it is of much of the beauty and simplicity of the writing, reducing it almost to a monotone in which the rhythm overrides both meaning and magic.

But to return to the actual plays and the performances on these two records . . . It would be hard indeed to find more imaginative, exciting or evocative material and these rich and robust performances are in every sense worthy of what undoubtedly must be some of the least known treasures of recent literature.

Recording and stereo are of the best quality and greatly enhance the whole. Highly recommended.

* * *

HUBERT GREGG AS JEROME K. JEROME. ARGO RG 3419.

These readings from "Three Men In A Boat" and "Three Men On The Bummel" would seem to be anachronisms in 1966 but I was surprised to find that a recent radio version with Hubert Gregg, Kenneth Horne and Leslie Phillips was one of the B.B.C.'s most popular offerings only last year. As B.B.C. comedy has a reputation which is second to none, I am prepared to cast aside my own prejudice — as prejudice it must be — and recommend these as doing the utmost justice to Jerome's material.

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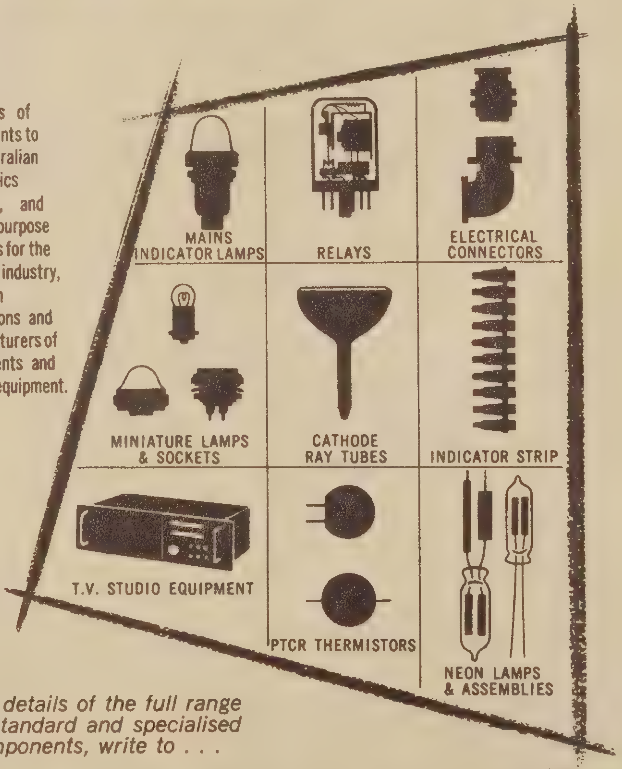

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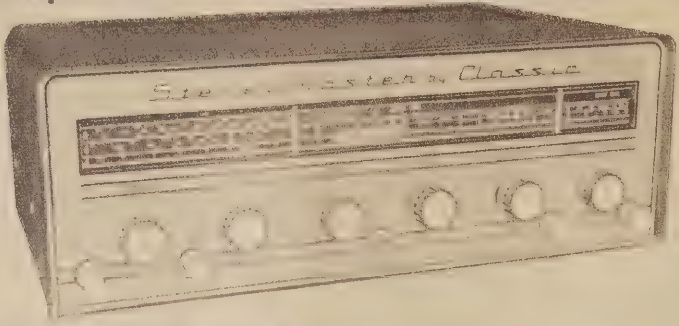

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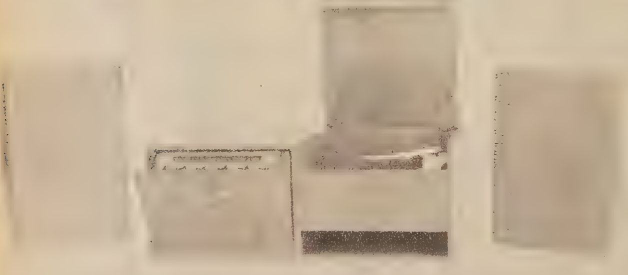

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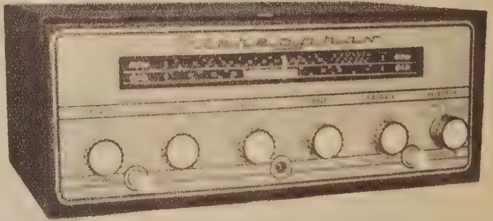

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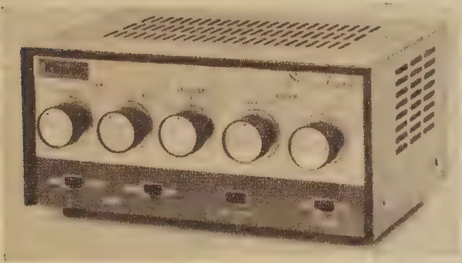

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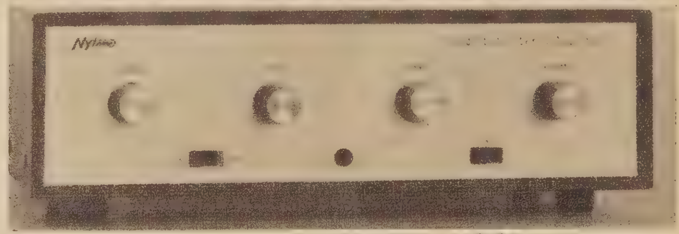

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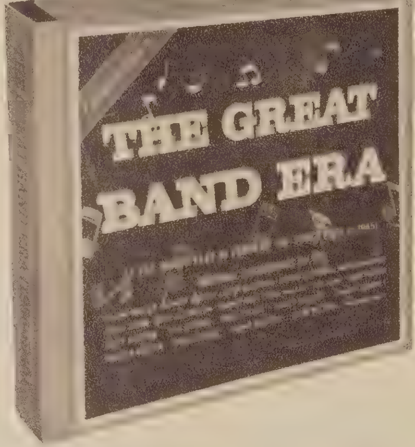

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VAUGHN MONROE: There I Go • When The Lights Go On Again • Tangerine • Rum And Coca Cola • There I've Said It Again.

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ARTIE SHAW: I Have Eyes • Do I Love You • Frenesi • This Time The Dream's On Me • I Don't Want To Walk Without You • Ac-Cent-Tchu-Ate The Positive • Nightmare.

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HAL KEMP: The Moon Got In My Eyes • I've Got A Pocketful Of Dreams • Sunrise Serenade • It All Comes Back To Me Now.

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VARIETY FARE

"ELECTRONICS Australia"
Staff Review
Panel

Devotional

HOIRSING With The Paul Mickelson Choir. Lorin Whitney, organ; Charles Magnuson, piano. Double-fold album with songbook included. Stereo, Supreme SS-2018. Also available in mono. (Supreme Productions Ltd., Box 15, Footscray, Vic.)

Interest: Popular Gospel, choir arrangements.
Performance: Highly competent.
Quality: Excellent.
Stereo: Normal spread.

Even as a straight presentation of ospel songs arranged for choir, this lbum would have an appeal of a high rder. The arrangements by Paul Mickel-on are excellent, skilfully combining egments of more or less conventional our-part harmony with developed themes hich the choir presents flawlessly and—o less important—reverently.

However, packaged with the album is copy of the song book containing all e hymns and arrangements in the same rder as they are presented on the disc. his gives the opportunity of reading the core as the music progresses or, if you el like singing for pleasure or practice, oining in with any section of the choir.

The titles: Singing I Go — All That hrills My Soul — I Will Sing Of My edeemer — Ten Thousand Angels — le Giveth More Grace — "Wonderful" ledley — Sweeter As The Years Go y — Zion's Hill — Let Thy Mantle all On Me — The Crystal Fountain — Victory" Medley.

In short, a most enjoyable record, ex-ellent for listening, for choral training r for an old fashioned, happy sing-a-ong. Recommended (W.N.W.)

* * *

HALL WE GATHER AT THE RIVER? Burl Ives. Arranged and conducted by Kurt Kaiser. Word (Gospel Film Ministry) WST-8339-LP.

Interest: Gospel sing-a-long.
Performance: Happy.
Quality: Not altogether clean.
Stereo: Good spread.

While Burl Ives is widely known in e entertainment world for his folk nging and his television roles, he is lso, by conviction, a very active Gospel nger. He is heard here fronting a large hoir in what sounds like a large audi-rium—to judge by the echo and lag in e massed voices.

All the tracks are well-known Gospel ymns, sung more or less straight and tomatically inviting listeners, who now them, to sing right along with the hoir: Shall We Gather At The River — How I Love Jesus — When We All et To Heaven — Power In The Blood — Bringing In The Sheaves — Lily Of The Valley — Sweet By And By —Will There Be Any Stars — The Unclouded Day — The King's Business — Showers Of Blessing — Love Lifted Me — Softly And Tenderly.

The album is complete with imported jacket carrying a large portrait of Burl Ives but, unfortunately, I can't give a clean bill of health to the local pressing inside. Though the stereo is well spread. my pressing had a slight "edge" on the massed voices when reproduced on wide-range equipment (elliptical stylus and all that). However, played on a modest portable stereogram, with crystal pickup and ordinary speakers, the effect was virtually inaudible.

In short, a happy disc of Gospel sing-a-long, but hi-fi enthusiasts had better be wary. (W.N.W.)

* * *

HYMNS OF THANKSGIVING. Choir, conducted by Ivan Rixon. Organ, Eric Smith, Mono, World Record Club 7012.

Interest: Congregational hymns.
Performance: Commendable.
Quality: Mostly good.

This is a companion disc to "Hymns of Praise" reviewed in these columns last month. Under the baton of Ivan Rixon, an experienced musician and conductor, a specially assembled choir presents another group of congregational hymns, in traditional four-part harmony, as commonly found in church hymnals.

Recorded in the Sydney studios of E.M.I., the choir is capably supported by Eric Smith playing a Hammond organ but suitably voiced for the purpose. The hymns on this second disc are: Onward Christian Soldiers — The Church's One Foundation — The King Of Love My Shepherd Is —Glorious Things Of Him Are Known — Jesus Christ Is Risen Today — The Head That Once Was Crowned With Thorns — Stand Up, Stand Up For Jesus — For All The Saints — Lord Of Our Life —Souls Of Men Why Will Ye Scatter — Come Down Oh Love Divine — He Who Would Valiant Be.

The quality is fairly good but, like the earlier disc, with traces of distortion here and there on peaks. However, it must likewise rate as a well-presented album and whether you choose either or both will depend mainly on the relative appeal of the hymn titles. (W.N.W.)

* * *

VOLUNTEERS FOR JESUS. The Heralds, male quartet stylings. Accompanied by Lareau Lindquist. Mono, Supreme M-101. (Supreme Productions Ltd., Box 15, Footscray, Vic.)

Interest: Gospel quartet.
Performance: Very competent.
Quality: Excellent.

John Nelson (1st tenor), Arnold Conrad (2nd tenor), Denis Ortlund (baritone) and Jon Gustafson (bass), first met when they entered Trinity College in Chicago as freshmen in 1960. All members of the Evangelical Free Church, they soon got together and formed a quartet known originally as the Freshmen Quartet, then the Trinity Quartet and now by the name which appears on this album.

Still together as a Gospel team, they have toured many States in the intervening years and what is heard on this disc is a mature quartet of still-young men, which is outstanding for its harmony, its balance and the general polish of the presentation. Nor should one overlook the pianist who backs them with a rippling piano accompaniment on all but two tracks, where organ and celeste are used by way of variation.

The titles, most of them well known, are: Jubilee — As A Volunteer — Deeper, Deeper — Saviour Thy Dying Love — So Send I You —Sunlight — Have A Little Talk With Jesus — The Old Account Was Settled — This World Is Not My Home —Trust In The Lord — More Love To Thee — O Say But I'm Glad.

Technically, the disc is very well recorded, adding up, in all, to a worthy addition to your collection. (W.N.W.)

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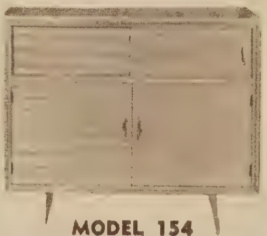

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SPECIFICATIONS—Dimensions: 13¾ x 11¾ inches, 1¾ above and 3 inches below chassis, Mat 9in dia. Weight: 8lb. Wow and Flutter: Less than plus/minus 0.15% peak. Rumble: 35 dB below reference level at 1.4 cm/100 cs. Speeds: 16 2/3; 33 1/3; 45; 78 rpm plus/minus 10% variation by means of small knob in the centre of the speed change button.

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The exquisite Model "STM" arm made in Denmark by B. & O. This features a lightweight aluminium tube with adjustable balance weight to give both static and dynamic balance so that only the special spring applies the stylus pressure and this pressure is independent of the slope of the record. Vibration or sudden movements of the mounting board have no effect on stylus pressure.

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The arm is designed to provide compensation for the skating effect. The stylus then bears equally on both sides of the groove (this feature is usually found only on much more expensive arms).

Distance from centre of pivot to centre of turntable 190mm.

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THE STUDENT PRINCE, Sigmund Romberg. Gordon McRae, Dorothy Kirsten, Earle Wilkie, William Felber, Richard Robinson, members of the Roger Wagner Chorale; orchestra and chorus conducted by Van Alexander. Mono, ENC. 9155. (Also available in stereo.)

Interest: Popular musical.
Performance Very high standard.
Quality: High standard also.

First launched on Broadway in 1924, The Student Price has charmed successive generations, despite the early apprehension about some aspects of the music and its bitter-sweet ending. What was not appreciated was the degree to which it communicates the nostalgia of Romberg for his own schooldays in Hungary.

The Student Prince (Gordon MacRae) is betrothed to a princess whom he has never seen but falls in love with a pretty waitress, Kathie (Dorothy Kirsten). They might have eloped, but for the death of his father, which obliges the Student Prince to assume the throne and, for state reasons, to marry the Princess, leaving Kathie to pine in loneliness.

The track titles: Overture and opening Chorus — Golden Days — Students' Marching Song, Drinking Song, Come Boys — Arrival at Heidelberg, In Heidelberg Fair, Gaudeamus Igitur — Deep In My Heart Dear — Drinking Song — Serenade — Just We Two — Finale.

The severely plain jacket of the present Encore series release is no match for the original and handsome Capitol jacket, which I have in my collection but there is a big price advantage and the music itself is precisely the same.

A most enjoyable record, musically and technically, on an economy label. (W.N.W.)

* * *

BACH: The Well-Tempered Clavier Vol. 3. Book 1, Preludes and Fuges 17-24. Glenn Gould, piano. C.B.S. Masterworks 12-inch stereo. SBR 235146.

Interest: Bach and Gould.
Performance: Crisp and buoyant.
Recording: Excellent.
Stereo Quality: Gives depth.

Ever since young Canadian pianist Glenn Gould gave his first big recital in Washington in 1955 he has continued to fulfil the predictions made then by dazzled music critics. His playing has lost none of the initial fire and crispness, precision and force; to these maturity and experience have added even greater powers of musical penetration and insight than before. Even more than with his first discs of the Goldberg Variations and the Partitas his recent discs seem to merit Professor Neuhaus' comment that "the music seems to speak through his playing; the composer has been dead long since, but his music is alive today and it will live long . . ."

On this disc he plays more of the delightful little Preludes and Fugues from The Well-Tempered Clavier, as the composer described them "For the use and practice of young musicians who desire to learn, as well as by way of amusement for those who are already skilled in this study . . ." And as one would expect Gould plays them impeccably; every note crisp and timed exquisitely, every run so even that one can almost apply a mental straightedge. Exercises, transformed every one into glowing experiences, buoyant and alive.

The recording is excellent throughout, with the microphones well placed to give pleasing depth and realism. Gould's usual vocal accompaniment is faintly in evidence here and there, but by no means distractingly so; it adds to the warmth almost subliminally.

To all Bach lovers who have not yet discovered Gould, a disc that can be warmly recommended. The others will undoubtedly need no encouragement. (J.R.).

* * *

GERMANY. Werner Muller and His Orchestra. Phase 4 stereo, Decca SKLA-7602.

Interest: German music.
Performance: Excellent.
Quality: Excellent.
Stereo: Outstanding.

Faced with the task of depicting the one word "Germany" on a single LP album, Werner Muller has followed the not-unexpected course of presenting a wide range of music which can variously be associated with the German scene.

With chorus, there's a drinking and a hunting song; also represented is honky tonk and rhythm, sentimental vocal, a wartime song, and a military band, a singalong, yodelling, romantic sound in the Billy Vaughn manner and, for those with longer locks, a touch of the classics.

Here are the titles: Drinking Song — Lorelei — Hoch Heidecksburg — Falling In Love Again — Lili Marlene — The Ride of the Valkyries — The Hunter's Chorus—Yours Is My Heart Again — Mack The Knife — In Munchen Steht Ein Hofbrauhaus — Liechtensteiner Polka — Auf Wiederseh'n Sweetheart.

The notable feature of the presentation is the way in which orchestra and chorus cope with this wide range of material. For all practical purposes, each track might as easily have been played by distinct groups having no connection one with the other.

Quality wise, the record is excellent and full marks must go to Decca for their use of the stereo facility. Definition and spread outweigh any thought of gimmickry, which the "Phase 4" system might imply. Listen, for example, to the march-by presentation of Lili Marlene.

As the jacket notes conclude, "Bravo, Maestro Muller." To which I could add "Bravo, Decca." (W.N.W.)

* * *

MICHELLE. Billy Vaughn and his Orchestra. Dot (Festival), Stereo SZL-931,872. Also available in mono, ZL-31,872.

Interest: Famous band — famous tunes.
Performance: Bright, entertaining.
Quality: Excellent.
Stereo: Noticeable spread.

Take a handful of famous tunes, arrange them in the Billy Vaughn manner, have them played by a group of skilled musicians, and you have the Billy Vaughn recipe for a successful disc. Represented here are the exciting rhythms of Latin America, the smooth flow of Broadway show melodies and the lively sound of modern "beat" music. Skilfully played by Billy and his team, they make entertaining listening. Very good quality sound and excellent stereo spread add to the enjoyment. A good party record.

Michele — I Will — Elaine — Organ Grinder's Swing — One Has My Name — Chim Chim Cher-ee — Mexican Shuffle — I Could Have Danced All Night — Watermelon Man — In the Chapel in the Moonlight — See See Rider—Bluebird of Happiness. (H.A.T.)

* * *

HERE COMES THE BAND. Massed bands of the Royal Australian Navy, conducted by Lt. Commander G. Hooker, M.B.E., L.R.A.M., A.M.U.A., R.A.N. Columbia-E.M.I., mono 330SX 7757. Also available in stereo, SCXO 7757.

Interest: Marching music.
Performance: Competent, strict time.
Quality: Good, but tending to harsh.

Having listened to the disc right through twice, I came to the conclusion that it is fine for marching displays, but played in the seclusion of one's home, it is rather boring. The collection

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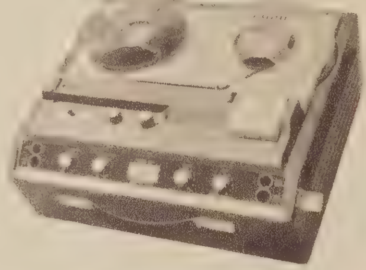

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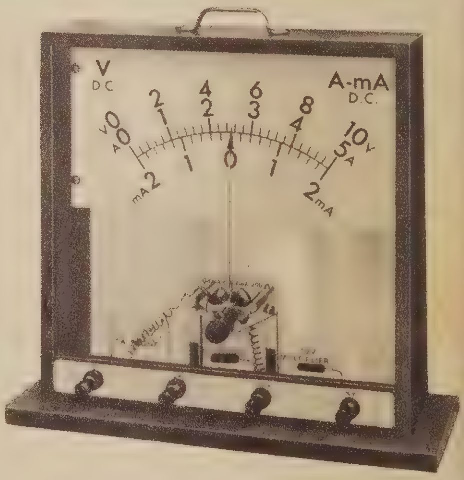

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of mainly undistinguished tunes is played at the unvarying pace of 120 paces to the minute, within the confines of a limited dynamic range (mainly loud). Despite some good playing by the band, each side seems to go on rather too long for home listening, so that it is almost a relief when the last track is ended.

The sound quality is rather strident, which seems to confirm the impression that the disc is intended to be used as accompaniment for marching displays and competitions. Played over public address systems it will no doubt sound appropriate at such occasions as this, but, in the home, it just doesn't seem to have the right sort of appeal.

Except for the rousing "King Cotton" by the undying John Phillip Sousa, the marches are by lesser known composers. The titles: Holyrood — Bravest of the Brave — My Regiment — Unter Den Linden — Through Night to Light — Waldmere — Officer of the Day — The Moray Firth — The Great Advance — Glorious Victory —King Cotton — Youth and Vigour. (H.A.T.)

★ ★ ★

SEMI-CLASSICAL FAVOURITES. Hugo Winterhalter and The Concert Orchestra. Stereo, Kapp (Australian Record Co.) PKS-6052.

Interest: Airs from the classics.
Performance: Melodic.
Quality: Excellent.
Stereo: Well spread.

If there is anything more evergreen than the evergreens from the world of popular music, it would be those from the light classics, as here presented. Merely to list the titles is to alert a whole line-up of potential buyers: Song of India — Lieberstraum — Clair de Lune — Humoresque — Caprice Viennois —Polonaise — Estrellita — Intermezzo — Theme from Grieg's Piano Concerto — Barcarolle — Reverie.

As might be expected of Hugo Winterhalter and The Concert Orchestra, the treatment is highly melodic, with plenty of singing strings, yet not to the exclusion of other instruments. The quality is clean, the frequency response wide and the stereo well spread — all in all, a record that I think a lot of people should enjoy. (W.N.W.)

★ ★ ★

HERB ALPERT'S TIJUANA BRASS, VOL. 2. Festival, Stereo SFL-931, 891. Mono FL-31,891.

Interest: Spanish and Latin American tunes arranged for brass.
Performance: Excellent.
Quality:Very good.
Stereo: Well spread.

In case you did not know, the Tijuana Brass takes its name fom the the Mexican town of Tijuana. Herb Alpert incorporated the sounds of the Tijuana bullring into a "smash hit" he recorded entitled "The Lonely Bull," and subsequently adopted the name for his band.

There is a happy relaxed South American feeling about the playing of Herb Alpert and his band on this record — an atmosphere of the fiesta, the bullbring and the cantina. This is enhanced by background noises of crowds enjoying themselves. with "Oles" and sounds of merrymaking appropriate to the various occasions. With the lively and entertaining playing of Herb Alpert's band, and the happy atmosphere, this could be a good disc to play on those days when nothing seems to go right — it's a tonic in itself.

The stereo is particularly effective in capturing the crowd atmosphere in the numbers where outdoor events are depicted.

The titles: La Virgen de la Macarena — Spanish Harlem — Swinger from Seville — Winds of Barcelona — Green Leaves of Summer — More — America — Surfin' Senorita — Marching Thru Madrid — Crea Mi Amor — Mexican Corn — Milord (H.A.T.).

★ ★ ★

MUSIC FOR SCOTTISH DANCING. Jack Seton and his Scottish Country Dance Orchestra. A series of six 45 rpm 7" EP discs released by RCA. Mono only.

Interest: See title.
Performance: Authentic.
Quality: Adequate.

Country dance groups will welcome this series of records made specially for Scottish dancing. They are conveniently grouped on 45 rpm EP discs and are played by a specialist group, led from the back—so to speak—by drummer Jack Seton. Seton is a prominent personality in New Zealand country dance circles and was first president of the N.Z. Country Dance Group. The group plays in authentic fashion, with the jaunty swing which characterises Scottish dance music.

The list of titles available follows. 20374. New Scotland Strathspey—La Tempete. 20375. General Stuart's Reel —Letham Ladies' Strathspey. 20376. Cottage by the Lea — Brig O'Doon — White Heather Jig. 20377. Lord McLay's Reel — Baldovan Reel —Mairi's Wedding. 20378. Govandale Reel — Oslo Waltz — Duke of Perth. 20379. Road to the Isles — Duke of Athol's Reel. (H.A.T.)

★ ★ ★

NERO GOES "POPS." Peter Nero and the Boston Pops Orchestra conducted by Arthur Fiedler. R.C.A. Dynagroove, Stereo LSC-2821. Also available in Mono, LM-2821.

Interest: Symphonic jazz.
Performance: Scintillating.
Quality: Very good.
Stereo: Very good.

"Symphonic jazz" was the creation of George Gershwin and survives today only in his works such as "Rhapsody in Blue" and "An American in Paris," which are still heard regularly in the concert halls. The enduring popularity of these works suggests that the lack of new works in the same vein is not so much due to lack of public interest, but of jazz musicians with sufficient skill to write music for a full symphony orchestra.

On this disc, Peter Nero sets out to prove that he has the necessary skill to orchestrate jazz for symphony orchestra. To set the mood, he first plays "Rhapsody in Blue" the way Gershwin wrote it, then he follows up with his own arrangements of some of the most popular of Gershwin's tunes. These are played with evident enjoyment by the Boston Pops Orchestra, especially the last number, which could be described as a modern jazz fantasy based on "I Got Rhythm," where pianist and orchestra really go to town, with Nero introducing quotations from Beethoven's "Waldstein" Sonata, the Turkish March from Mozart's Sonata in A Major (not, in-

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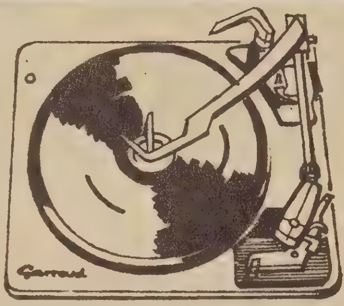

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Compliance: 10×10^{-6} cm/dyne.
Tracking wt.: ¾-6gms.
Stylus: .7 mil Diamond.
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Freq. Resp.: 8-28,000 cps.
Compliance: 15×10^{-6} cm/dyne.
Tracking wt.: 2-4 gms.
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Model 222 Integrated Stereo amplifier
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Model 227 Stereo Tuner Amplifier.
Model 127 Stereo Tuner Amplifier.
Model 221 Integrated Stereo amplifier

MODEL 888PE
Freq. Resp.: .6-30,000 cps.
Compliance: 20×10^{-6} cm/dyne.
Tracking wt.: ½-3 gms.
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cidentally A minor, as stated in t
sleeve note), and Liszt's "Liebestraum
presumably to show that there is reall
not that much difference between th
two styles. Plenty of fireworks and goo
humour in this disc. The sound is exce
lent too, but the stereo separation tend
to be overwhelmed by the sheer ma
of sound in parts.

Rhapsody In Blue — Love Is Her
To Stay — Embraceable You — Th
Man I Love —They Can't Take Th
Away From Me — Bidin' My Time —
I Got Rhythm. (H.A.T.)

★ ★ ★

**RUSSIAN MANDOLINS. The Mei
University Mandolin Club, arran
ed and conducted by Akira K
machi Festival 12 inch Stere
SFL-931,848. Also in mono
FL31,848.**

Interest: Mandolins play Russia
melodies.
Performance: Bright, rhythmic.
Recording: Top-notch.
Stereo Quality: The same.

Another top-quality recording fro
Festival and their associates Kin
Records in Japan. This one featur
the Meiji University Mandolin-Clu
playing favourite Russian melodies.

The play with great warmth an
enthusiasm fourteen sparkling arrang
ments of the following tunes: Lam
Light — Suzuran — Dark Eyes —
The Waters of Baikal — Stenka Rasin —
Chiisai Gumi No Ki — Two Guita
— An Evening in the Suburbs of Mo
cow — Kachusha, Suriko — Troika —
Ural No Gumi No Ki — Karinka —
Red Sarafan.

The recording is of really super
quality throughout, as one has come
expect from King Records. Stereo
well spread and with a realistic pseud
"centre channel."

An excellent disc, either for listenin
or dancing. (J.R.).

★ ★ ★

**CLASSICS WITH A CHASER. Volum
1, 2 and 3. Caterina Valente an
the Werner Muller Orchestr
Mono, 45EP R.C.A. Gold Lab
20365, 20366, 20367.**

Interest: Classics, original an
adapted.
Performance: Good.
Quality: Normal mono.

Followers of the classics are som
times upset when they recognise
familar theme being made the vehic
for "familiar" lyrics, using the adjecti
in quite another sense. Or it ma
happen the other way round, when
pop fan comes across a modern h
tucked away in stuffy cold classic!

For your enlightenment and possib
entertainment Werner Muller and h
orchestra present half a dozen them
from the Classics, followed respective
by the popular adaptation defined he
as the "Chasers."

The three discs are as follow:

Volume 1, 20365: Theme from Co
certo No. 1 in B-Flat Minor Op.
(Tchaikowsky), Tonight We love. R
verie (Debussy), My Reverie.

Volume 2, 20366: Polonaise No.
in A-Flat, Op. 53 (Chopin), Till T
End Of Time. Melody, Op. 42, No.
(Tshaikovsky), The Things I Love.

Volume 3, 20367: Theme from Co
certo No. 2 in C-Minor Op. 18 (Rac
maninoff), Full Moon And Empty Arm
Theme from Polovetzian Dances (Bor
din), Stranger in Paradise.

Discs with an "angle" that may well be of special interest (W.N.W.).

* * *

LATIN SONGS EVERYBODY KNOWS
George Feyer At The Piano. Stereo, Universal Record Club SUP-687. Also available in mono.
Interest: Rhythm piano.
Performance: Entertaining.
Quality: Excellent.
Stereo: Separates piano, percussion.

Some time ago, George Feyer released an album of French songs which was quite delightful, followed by one of Italian melodies, which I don't remember so well. Here the one-time classical pianist from the Budapest Conservatorium of Music turns his attention to Latin-style rhythm with the theme "Magyar-Gone-Latin."

And frankly, I doubt that there's a more entertaining pair of hands in the world of show pianists, producing a sound that is clean, sparkling and highly rhythmic but with never a hint of the mechanical.

On both sides, number follows number, with a barely perceptible pause between tracks: Yours — Green Eyes — Perfidia —Ay-Ay-Ay — Desafinado — El Choclo — Amapola — Tico-Tico and Yours — Andalucia — Perhaps, Perhaps, Perhaps, — La Cumparsita — La Golondrina — Capullito De Aleli — You Belong To My Heart — Cielito Lindo — Brazil — Andalucia.

If you want to sample just one track, listen to the Tico-Tico/Yours medley. It's a wow!

Recommended (W.N.W.)

* * *

JEANETTE MACDONALD IN OPERA. Mono, RCA Gold Standard 45 EP 20,347.
Interest: Once popular soprano.
Performance: Good.
Quality: Acceptable.

Though probably best known for her musical comedy roles, particularly in association with Nelson Eddy, Jeanette Macdonald had considerable ability as an operatic soprano. On this disc, RCA have associated Ouvre Ton Coeur (Carmen) — Waltz from Romeo and Juliet —Le Roi de Thule (Faust) — Jewel Song (Faust).

Dubbed from earlier recordings, the quality is quite acceptable though the sound is completely "dry" — or lacking in reverberation — in the style of the period. Perhaps this is as much as anything the reason why the voice lacks something in roundness, though pitch and control are good. (W.N.W.)

* * *

COUNTRY AND WESTERN SERIES. Re-issues of recordings by popular performers on 45 r.p.m. discs by RCA. Mono only.

The performances on these discs are typical of the "gather round" Western type radio shows popular in U.S.A., and the performers are all no doubt well known to American radio audiences. Whether they have any following here is a matter for conjecture.

On separate discs, Jimmy Rogers, Wilf Carter and Porter Waggoner sing various humorous, mournful and cynical songs in the pleasant Western twang of their genre. I especially liked the warm, vibrant voice of Dottie West, and her rendering of "Mama, You'd Have Been Proud Of Me."

As for the Carter Family, their deadpan delivery and grating mountain-country accent exercise a fascination which is hard to explain. They sound so serious, yet their very earnestness has a kind of comic quality of which they were probably blissfully unconscious. You either like them or you don't, and I suppose this applies to all the performers represented on these discs.

Here is the complete listing of the five records received:

20343. IN THE JAILHOUSE NOW. Jimmy Rogers singing: In the Jailhouse Now — Nobody Knows But Me — Moonlight and Skies — Whippin' That Old T.B.

20368. REMINISCING WITH WILF CARTER. Wilf Carter singing: Old Shep — The Fate of the Strawberry Roan — The Streamlined Yodel Song — My Swiss Moonlight Lullaby.

20369. SWEET FERN. The Carter Family singing: Diamond in the Rough — Sweet Fern — The Wabash Cannonball — Wildwood Flower.

20371. HERE COMES MY BABY. Dottie West singing: Here Comes My Baby — Mama Kiss the Hurt Away —

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GL-70

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N.T.: Pfitzner's Music House, Smith Street, Darwin. Tel. 3801

ama, You'd Have Been Proud of Me
All the World is Lonely Now.

20372. MEMORIES OF THE PAST. rter Waggoner singing: My Friends e Gonna Be Strangers — Sorrow on Rocks — The Bride's Bouquet — emories from the Past.

RCA gives no clues as the history of recordings, but to judge from the und quality, which varies widely from cord to record, some go back quite a w years, while others are of more cent vintage. The Carter Family have t made records for a very long time, d their record sounds as though it has en taken from a 78 rpm disc of prear days. (H.A.T.)

* * *

ODAY'S GREAT HITS. Lawrence Welk and His Orchestra. Dot (Festival) stereo 12-inch, SZL-931,828. Also in mono on ZL-31,828.

Interest: Recent Hits.
Performance: "Big" and bright.
Recording: Excellent.
Stereo Quality: Smooth, wide.

A fine disc of recent hit tunes and emes, brightly arranged and played pansively by Lawrence Welk and his chestra. The tunes they play are:

La Bamba — Summer Nights — A aste of Honey — Unchained Melody Summer Wind — The "In" Crowd— oonlight and Roses—Hold Me, Thrill e, Kiss Me — Yesterday — Hush, ush, Sweet Charlotte — Send Me The llow You Dream On — Heartaches y The Number.

The recording quality is excellent, ith low noise and distortion and noothly spread stereo. Recommended. .R.)

* * *

EMS BY THE MILLS BROTHERS, with orchestra conducted by Billy Vaughan. Universal Record Club, Stereo SUP-742 (also available in mono, UP-742).

Interest: Popular vocal group.
Performance: Fair.
Quality: Good.
Stereo: Average.

To this reviewer, the combination of e Mills Brothers and Billy Vaughan's rchestra is not a completely happy one that either group, alone, might well ave produced the numbers on this atter to better advantage. When listeng to the various tracks, one gets the eling that each group is detracting om the other's performance. My pernal preference is for the characteristic resentation of the Mills Brothers or the neful Billy Vaughan orchestra — parately!

The songs on the disc are: It Hurts e More Than It Hurts You —Don't lame Me — Dream A Little Dream Of e — If I Could Be With You — My lent Love —Sweethearts On Parade— hinking Of You—I Still Get A Thrill— here's Danger In Your Eyes, Cherie— ar Away Places—You're Driving Me razy—We Just Couldn't Say Goodbye.

A somewhat disappointing disc even ough featuring top performers (K.W.)

* * *

LADYS MONCRIEFF ENCORES. Colombia, Mono. 330SX-7752.

Interest: Popular soprano in her heyday.
Performance: Good in its way.
Quality: Reasonable for the period.

It's rather startling to realise that ladys Moncrieff, affectionately remembered by many as "Our Glad" made her al professional debut in the 1914 ydney season of Gilbert and Sullivan; that she made her first big hit in "The Maid Of The Mountains" in 1921 — nearly ten years before her records became so familiar on the Australian air waves.

And yet it's only a few years since she retired after entertaining the troops in Korea, appearing on Australian television and doing a successful Australian and New Zealand tour in "Many Happy Returns."

These present recordings, for the most part in collaboration with Gil Dech and his orchestra, date from the period 1929 to 1935. In the stilted manner of the day, with the limited fidelity and minus any of the modern sonic techniques, they have little to offer presentday ears — yet they reveal a voice which is notable for its pure tones and true. These were days when a singer had to rely on merit and musicianship.

The titles: L'Amour, Toujours L'Amour — Love Is A Dreamer — Speak To Me Of Love — I Was Dreaming — The Purity Brigade — Where The Shannon Flows Down To The Sea — Smiling Irish Eyes — Come Back To Me — Love's Young Dream — I Wait For You — Heavenly Night — A Wee Bit Of Love.

Mainly of interest to the "fifty and overs." (W.N.W.)

* * *

ONE STEP MORE. The Good Time Singers. Stereo, Capitol (EMI) ST-2170. Also available in mono.

Interest: Popular fare in true hi-fi.
Performance: Very capable.
Quality: Excellent.
Stereo: Most impressive.

I belong to the wrong age group altogether for this to be my kind of music — a medley of rock, folk, hill-billy and spiritual, given the modern, driving, teenbeat treatment. But this I must say for the Good Time Singers, fresh from their successes on the TV, "Beverly Hillbillies" and the "Andy Williams Show," they make their kind of music very well indeed, vocals, send-ups and all.

What's more, with the help of Capitol engineers, they have produced some really impressive sound in the pop manner. Most of the time, the vocal group stands solidly in the vacant space between the speakers, with whisps of accompaniment coming from either side. But when they adopt another arrangement, the positioning is equally positive.

The tracks: Gimme Some —Li'l Ole Road — Little Maggie — Homestead In The Bay — The Man On The Flying Trapeze — Walk The Floor — Hoo How What Now — Put On Your Sunday Clothes — Bury Me Beneath the Willow — Pearly Shells — Looking Back To See — One Step More.

Excellent, if you like the modern sound. (W.N.W.)

* * *

JOHN GARY SINGS YOUR ALL-TIME FAVOURITE SONGS, arranged and conducted by Dick Reynolds. Stereo, RCA Dynagroove LSP-3411 (also available in mono, LPM-3411).

Interest: Popular favourites.
Performance: Smooth.
Recording: Excellent.
Stereo: Normal spread.

John Gary is a popular artist with a smooth and pleasant-to-listen-to voice. Coupling his performance with the established favourites presented on this disc

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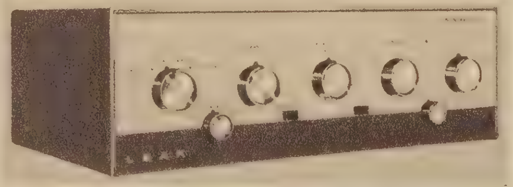

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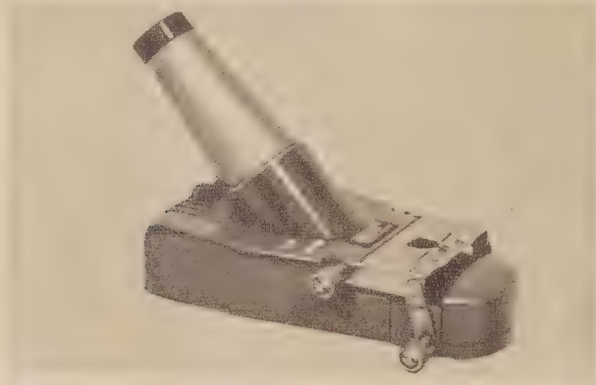

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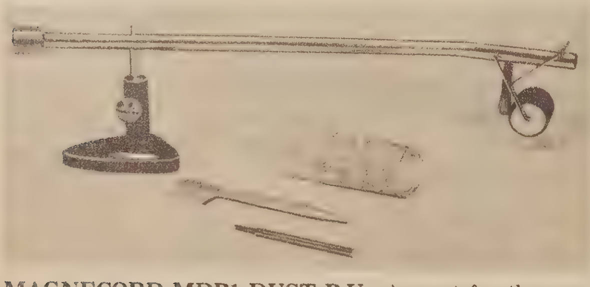

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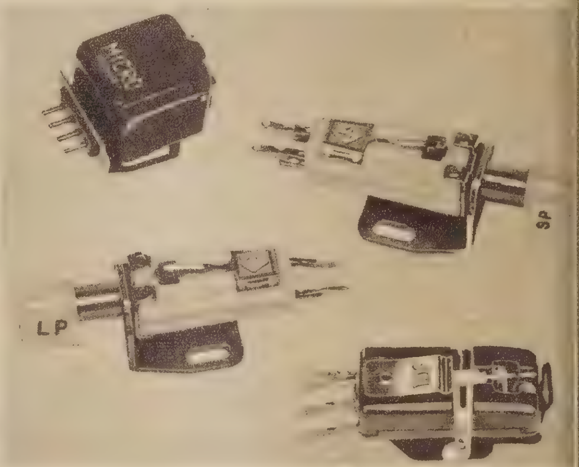

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has produced a combination which should appeal to lovers of popular music. If any fault could be found with the recording it is more with the arrangement than the artist. In two of the tracks the arrangement deviates markedly from the accepted style. Occasionally, also, the accompaniment is allowed to dominate the voice.

The tunes played are: All the Things You Are — Night and Day — Fascination — Star Dust — As Time Goes By — Smoke Gets in Your Eyes — I Left My Heart in San Francisco —Autumn Leaves — Some Enchanted Evening — Deep Purple — Tonight — You'll Never Walk Alone.

With the smooth presentation of the above numbers and the excellent recording quality, the album should win a place in many record libraries. (K. W.)

★ ★ ★

FAVOURITE FOLK SONGS OF JAPAN. Takeshi Terauchi and Blue Jeans. Festival-King Records, Stereo SFL-931,847.

Interest: Modern arrangements of Japanese songs.
Performance: Reasonable.
Quality: Good.
Stereo: Effective spread.

This is not folk singing as we know it, but arrangements for electric guitar group of what presumably are popular traditional songs in Japan. There is no sleeve note to provide background information. The record is interesting in that it indicates the way popular music is developing Japan. While the themes are definitely oriental, the Western influence is strongly in evidence in the arrangements and presentation. To underline the point, in one number the theme is first chanted in the traditional Japanese manner, then it is taken up by the group and given the rather more modern treatment. This consists of harmonising guitars, with percussion giving a strong beat.

There are 11 numbers on the disc, but it is pointless giving the titles here, since no translation is given for the Japanese titles. The main point is —will Australians like the music? I think it will appeal to many people here. For example, it was an immediate success with my two teenage daughters. If you want something a little different in your record library, this could be worth a hearing. (H.A.T.)

★ ★ ★

SING WITH SEEGER. Pete Seeger, folksinger. HMV 12-inch mono, OXLP-7504.

Interest: Folk.
Performance: Good but cool.
Recording: Very good.

Much as I admire no-nonsense folkie Pete Seeger and enjoy listening to his singing, I find this disc quite disappointing. I think it would have been loads better had it been recorded "live" with audience participation. To hear Seeger singing and playing all on his lonesome for all but one track is just too cool and sobering. It's almost a self-contradiction: Folksongs without the "folk."

Before I'm howled down about this let me hasten to add that I quite realise that folksongs are equally for self-enjoyment as for group entertainment; I also realise that the idea of the disc is that disc listeners are invited to join in the choruses. Nor am I saying that Seeger is not capable of singing well by himself — he does so here. What I am saying is that a "live" performance (or a recording of one) not only provides the performer with "feedback" of audience reaction, to "warm things up," but it also gives the disc listener a chance to identify with the original listeners.

Any singer, whether he be Seeger or anyone else, is bound to give more of himself when singing before at least a small audience; similarly any listener is more likely to join in when he is doing just that — "joining in" with people already singing the chorus.

Enough said on this score; apart from this coolness the disc is quite good, as one would expect from Seeger. The songs he sings are Run, Come See Jerusalem — The Water Is Wide — Careless Love — Houston Train—Oh Susanna — John Riley — Dayenu—Mary Don't You Weep — Stewball (with support) — The Keeper — Little Black Bull—The House Carpenter.

You'll have to supply your own warmth. (J.R.)

POPULAR JAZZ

Reviewed by GRAEME BELL

JOE AND EDDIE LIVE IN HOLLYWOOD. Vocal Duo with rhythm accompaniment. Mono, Vocalion VA 7005.

Interest: Live vocal folk-jazz-gospel.
Performance: Exuberant.
Quality: Very good.

Joe and Eddie are two young Negroes who are more than just a vocal duo—in fact, they are entertainers, and this, their second L.P., was recorded "live" at The Troubador and Mecca nightclubs in Hollywood.

When entertaining a live audience, visual and auditory appeal are of equal importance, and therefore humorous asides and facial expressions mean little on record.

On the other hand, freshness and vitality, so difficult to obtain between the four walls of a studio, are very evident in this recording which includes Bob Dylan's composition "Farewell," Ma Rainey's "C.C. Rider" and several folk-gospel compositions by a young American composer by the name of Bob Gibson.

In a cover note, Joe and Eddie say that they hope to visit Australia soon.

DIXIELAND JAZZ. By world-famous musicians. Mono. Universal Record Club UJ729.

Interest: Dixieland Jazz.
Performance: Varied.
Quality: Varied.

Side One is poorly recorded, and features run-of-the-mill dixieland by Bobby Byrne, Peewee Irwin, Peanuts Hucko, Billy Maxted, Eddie Safranski and Cliff Leeman playing tired old tunes such as "The Saints," "Jazz Me Blues," "Basin Street Blues" etc.

Side Two has life and vitality in both recording and performance, and features Rex Stewart, Bud Freeman, Bill Stegmeyer, Louis Stein, Barry Galbraith, Trigger Alpert, Will Bradley and Paul Kashian playing a much more imaginative selection, including "I'm Coming Virginia," "Milenburg Joys" "Surrender Blues" etc.

Rex Stewart and Bud Freeman, both of whom impressed when in Australia, are the stars of this side, and create a contemporary excitement and warmth.

The record is worth buying for side two alone, which is as full of interest as side one is full of dullness.

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TRADE REVIEWS AND RELEASES

Fisher Amplifiers and Speakers

As readers of our advertising columns will have noted, the highly esteemed stereo component range of the well-known Fisher Radio Corporation of New York is now available in Australia. The amplifier and speaker enclosure pictured were sent for review as representatives of the Fisher range by the sole distributors, RCA of Australia Pty. Ltd.

The X-101-C "Master Control-Amplifier" is an integrated control unit-main amplifier which offers high-power capacity and extended functional versatility combined with a marked simplification of operation. This makes it ideally suited both for those who need an amplifier system capable of dealing with a very large room (or inefficient speakers) and for those who yearn for an amplifier which can be operated in full confidence despite the lack of a pilot's licence or an engineering degree.

To deal with the operational side first, the X-101-C presents the non-technical user with a delightfully simple array of front-panel controls: two control knobs and five push buttons. These are mounted tastefully on the upper section of the panel, which is a most attractive gold-anodised aluminium extrusion. The five buttons to the left are input selectors, marked TAPE HEAD, PHONO, TUNER, AUX, and TAPE PLAY; balancing these on the right are the knobs, marked MODE (mono-stereo-reverse) and VOLUME (includes power switch). Under the signature in the centre of the panel are a tiny "Jewel" pilot bezel and a jack for stereo phones.

These controls are all that the non-technical music lover need worry about, at least for most of the time. For the odd occasions when he or she feels ambitious, however, they can join the technical types and venture further.

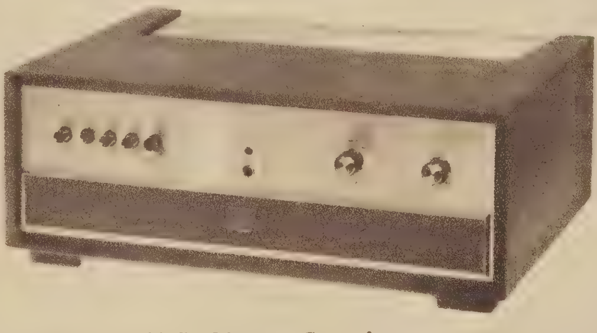
This simply involves pressing down and drawing outward the trade-mark knob in the centre of the black lower portion of the panel. The black panel is in fact a cover for the remaining controls, which are inset from the main panel extrusion and consist of four rotary controls and four slider switches. To avoid having to peer into the inset portion to identify the controls, Fisher have provided a clear and unambiguous legend on the rear of the swing-down cover.

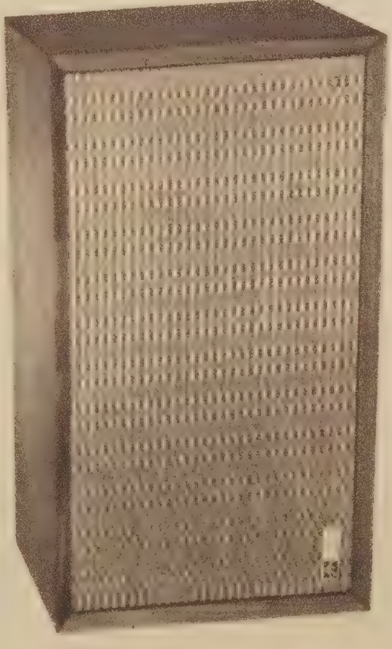
From left to right the controls consist of EQUALISATION (Tape-phono) and HF FILTER switches, an OUTPUT SELECTOR (to be discussed in a moment) concentric BASS and TREBLE controls fitted with clutch-type knobs, the BALANCE control, and finally switches for TAPE MONITOR and LOUDNESS CONTOUR.

Finding the EQUALISATION switch among the normally hidden controls is a trifle disappointing, it must be admitted; one would have expected Fisher to have incorporated the equalisation switching as part of the TAPE HEAD and PHONO push buttons. However, this is perhaps not too serious as few users are likely to wish to feed signals in direct from a tape head; thus in the majority of cases the switch will remain permanently in the "phono" position.

The OUTPUT SELECTOR switch deserves special mention because it is a fairly unique feature. At a flick of this switch one can select almost any combination of speakers and stereo phones: PHONES ONLY, ALL SPKRS, (which includes an optional centre speaker), LEFT + RIGHT, and CENTRE + PHONES. The final position allows the use of a remote speaker fed from the centre mono outlet, together with stereo phones.

The rear of the X-101-C presents a neat and orderly array of input and output connectors, together with a cartridge fuseholder and two mains outlets which are switched along with the amplifier. Each channel has three low-level inputs (TAPE HEAD and HI and LO PHONO), four high-level connectors (TUNER, AUX, TAPE PLAY and RECORD OUT) and four speaker terminals (C-4ohm-8ohm-16ohm). In addition there are sockets for connection to the Fisher "Spacexpander" reverberation unit (the sockets are normally linked), terminals for the centre speaker and screwdriver adjustments for phases inverter balancing and output valve bias.


Fisher X-101-C Master Control Amplifier.


Fisher XP-6 loudspeaker system.

The unit contains 10 valves: three 12AX7/ECC83s and two 7591 beam power valves per channel. One 12AX7 is used in each channel as the tape head/magnetic pickup preamp; another as voltage amplifiers before and after the passive tone controls; and the third as input stage and split-load phase splitter in the power section. The 7591s are operated in class-A push-pull, their heavy cathode currents being used to provide hum-reducing DC heating for the four 12AX7s in the preamp section. In all, the design appears to be a thoughtful and conservative one.

The negative feedback applied to each channel amounts to approximately 20dB, testifying that Fisher use high-quality output transformers; damping factor is approximately 10. The power consumption is 180 watts (210 VA).

As expected, the performance of the X-101-C under test easily met the Fisher specifications. Power output before clipping was 28 watts (RMS) plus per channel, exceeding the corresponding "total music power" of 60W claimed by Fisher; T.H. distortion was well below the claimed 0.5 per cent at full output; frequency response and power response were both excellent at within 1dB from 30cps to 20KC with the controls flat.

Hum and noise for shorted inputs was commendably low at -60dB below full output (low level inputs) and -85dB for the high-level inputs. The bass controls permit approximately 11dB boost or cut at 60cps, and the treble controls approximately 10dB boost or cut at 10KC; control interaction is quite small. The HF filter gives a fairly sharp rolloff at approximately 6KC.

A square-wave test showed the amplifier to have excellent transient response. A slight trace of overshoot was present, but with no trace of ringing; presenting the amplifier with capacitive loads increased the overshoot a little, but could not induce instability.

In short, then, the X-101-C is a well-made component and an excellent performer and easily qualifies as a member of the elite among stereo amplifiers. As such the quoted price of $296 seems not unreasonable.

Incidentally, the amplifier is not normally supplied in the wooden case shown, and the price quoted above is for the amplifier alone. For those who so desire, cases are available at additional cost.

The XP-6 loudspeaker system measures only 13in x 23in x 10½in and weighs 35 pounds. It is made from stout ¾in flakeboard, covered on all sides with walnut veneer to permit either vertical or horizontal use. The walnut veneer is given a natural-oiled finish.

Three speaker units are employed in the enclosure: a 10-inch woofer (20cps free air resonance) in a sealed compartment, with a 5-inch mid-range unit and a 1½-inch tweeter in separate AcoustiGlas-filled sub-enclosures. Frequency division is performed by a pair of 12dB/octave crossover networks. The 10-inch woofer is of the "free

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Price Retail £19-5-0
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H. 450/5

Low frequency cut-off	150 Hz
Sound distribution	85 deg.
Air Column length	915 mms.
Maximum diameter	445 mms.
Maximum length	540 mms.
Weight	4 kgs.

It may be supplied also without cover-hood for fitting the driver unit model 2545 TS.

Power rating	25 wa
Watts peak	45 wa
Voice coil impedance	16 oh

Built-in line matching transforme
16—165—250—500—1000
2000—3000 ohms

Frequency response	80-12,000

Watertight construction
Equalised compression system

Maximum diameter	110 mm
Maximum height	150 mm
Weight	2180 g

Price Retail £37-1-0
Plus Sales Tax £4-12-8

ZEPHYR

ZEPHYR PRODUCTS PTY. LTD.
58 HIGH STREET, GLEN IRIS, S.E.6, VICTORIA
MANUFACTURERS OF RADIO & ELECTRICAL EQUIPMENT & COMPONENTS

piston" type. Frequency response of the system is quoted as 35cps—20KC.

In listening tests, the XP-6 proved capable of excellent reproduction; although most members of the staff listening panel found the bass a little prominent compared with middle and high frequencies, and preferred a degree of bass cut and treble boost to achieve a subjective "flat" sound. With this small adjustment of the controls, a pair of XP-6s team with the X-101-C amplifier to produce some quite superb sound. (they can, of course, be used with other high-power amplifiers, with similar results.)

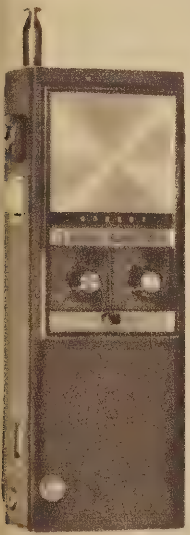
Efficiency is a little lower than some bookshelf-style enclosures which we have tested, and somewhat lower than our own Playmaster 109. This is to be expected from the long-throw suspension employed in the "free piston" type of woofer unit, and agrees with Fisher's suggestion that 10 watts be the minimum input level. Maximum power capacity is quoted as 60 watts.

Price of the XP-6 system is quoted as $152, placing the enclosure in the bracket primarily of interest to "well-heeled" connoisseurs; however, to these few, it can be recommended.

Further details on Fisher amplifiers and speaker systems may be obtained from audio dealers or direct from RCA of Australia Pty. Ltd., 221 Elizabeth Street, Sydney. (J.R.)

MINIATURE TRANSCEIVER

CONVOY INTERNATIONAL PTY. LTD. recently forwarded a pair of solid state transceivers for our inspection. These transceivers, operating on 27.24MC, are capable of radiating 1 watt of carrier power. The transmitter section under test proved to be quite effective, the higher power rating comparing more than favourably with the more usual low power 100mW, units tested under similar conditions.



The receiver section, while exhibiting good sensitivity, was somewhat disappointing in regard to the operation of the built-in noise limiter, there being little apparent difference with the noise limiter switched in or out of circuit. Against this, however, receiver incorporates a variable squelch control which, used intelligently, can reduce listening fatigue considerably in noisy surroundings. The squelch control is normally set till the background noise is barely discernible. An incoming signal will trigger the squelch circuit, allowing the modulation to be heard as normal.

A small battery meter allows the state of the batteries to be continously monitored. Provision is also made for the use of external batteries, which allows the use of larger primary cells or rechargeable nickel cadium batteries. The latter with charger and/or car battery cord are extras.

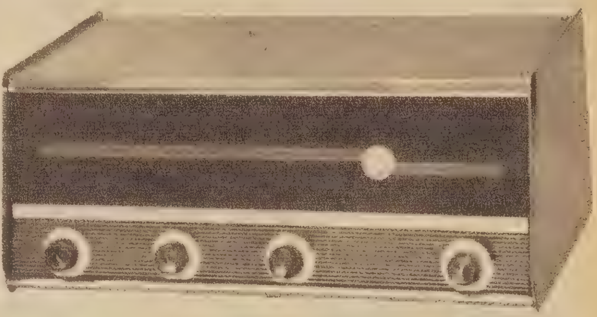
The unit is well finished and should survive the normal wear and tear to which portable equipment is submitted. The solid construction has resulted in the weight of the unit being higher than some others handled but is well worthwhile for the protection afforded. Convoy International Pty. Ltd, 449 Kent Street, Sydney advise that these units cost $116 (£58) each, tax paid. (K.W.)

ZEPHYR 35W PUBLIC ADDRESS AMPLIFIER

The amplifier pictured is a Zephyr PA-35 public address unit intended for use in clubs, restaurants, conference rooms and other applications requiring a general-purpose amplifier of moderate power capacity. It is rated at a nominal 35 watts RMS. A similar unit rated at 65 watts is available.

The PA-35 is unassuming in size and weight (16in x 9¼in x 6½in, 21 pounds) and is housed in a sturdy blue-grey lacquered metal cabinet with black and gold front panel. It has only four controls — microphone volume, pickup volume, tone and power on/off, making it quite suitable for operation by non-technical personnel.

Single microphone and pickup inputs are provided, the two being mixed together in standard fashion to permit smooth blending or changeover. The microphone input will normally accept only high impedance dynamic microphones (100K input impedance) but can be adapted for low impedance types. The input sensitivity for full output was measured at 2.75mV at the microphone input and 150mV at the pickup input. Pickup input impedance is approximately 1 Meg.



The PA-35 uses two 6DQ6B valves in push-pull in the output stage and two 12AX7s for preamplification and phase division. The 6DQ6s are operated with fixed bias, and under test would deliver a clean 40 watts RMS into a suitable load. As the output is wired for a 100V line distribution, optimum load corresponds to 330 ohms.

Frequency response of the unit reviewed was 3dB down at 30cps and 8.5KC with the tone control fully clockwise; turning the tone control right off dropped the HF response quite drastically. Signal-to-noise was a good 60dB (referred to full output). In short, the performance is quite good, considering the intended application.

The only criticism we would make about the unit is with regard to the pilot lamp mounting: the bulb and its socket are simply floating in mid-air behind a translucent section of the front panel. Surely it would not add appreciably to costs to fit a small metal bracket for support of these components, to round off an otherwise quite tidy design.

We have not seen the higher-power PA-65 unit but from the literature it would appear to be very similar both physically and electrically. Both employ a silicon-diode power supply circuit for efficiency and reliability.

Price of the PA-35 is quoted as $117.25 plus tax, and for the PA-65 $138.60 plus tax. Enquiries should be directed to audio dealers or direct to Zephyr Products Pty. Ltd. at 58 High Street, Glen Iris, Victoria. (J.R.)

Paton

Model MX64A **MULTIMETER**

D.C. Sensitivity—20,000 Ohms/Volt

FEATURES:

- Press-button Overload Cut-out Relay.
- Single Knob Operation.
- 6-inch Mirror Scale.
- Two-terminal operation (to 1,000 V.)
- Semi-hard Rubber Housing.
- Taut Band Suspension.
- Accessible Battery Compartment.

RANGES:

A.C. & D.C. Volts to 3,000V. (12 Ranges)
A.C. & D.C. Amperes to 10 Amp. (10 Ranges)
Ohms (to 50 Megohms) (3 Ranges)
dB Ranges (6 Ranges)

LIFE SERVICE

Model 64A is made in Australia (25 years' experience) and is backed by Factory Service. Do not underestimate this advantage.

Price: $88.20

Plus 12½% Sales Tax. TERMS AVAILABLE.

Send for full details

PATON ELECTRICAL PTY. LTD.

90-94 Victoria Street, ASHFIELD, N.S.W. 71 0381

WARBURTON FRANKI

ELECTRONIC EYES

Nicholls (Aust. made)

Complete assembly consisting of Control Unit, Lamp Head, Buzzer, Connecting Wire, Staples, Screws and Spare Lamp. Will work across distances of up to 25ft. Ideal for Door Alarms, Burglar Alarms etc.

$39.75

plus pack & post 25c.

RECORDING TAPE

Special Low Prices While it Lasts

AMERICAN PROFESSIONAL QUALITY—
IRISH—Mylar Base

3"	225'	$1	Post Free
5"	900'	$3	" "
5¾"	1150'	$4	" "
7"	1800'	$5	" "
7"	2400'	$7	" "

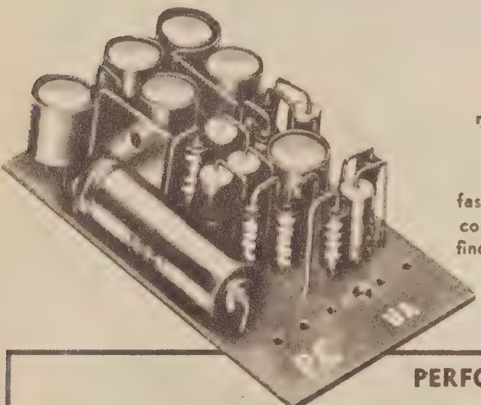
ELECTRONIC KITS

NO SOLDERING REQUIRED

MAKES: 1 Germanium Radio
2 Transistor Radio
3 Morse Key (Supplied) Buzzer Set.

$7.95 POST FREE

NEWMARKET PACKAGED CIRCUIT AMPLIFIERS



The Newmarket PC range provides Development Engineers with reliable pre-tested units of tight performance specifications to incorporate in any equipment at minimum cost. Use of such units not only obviates the need to develop purpose made amplifiers for every job, but cuts down the number of small components that company Buyers have to buy and maintain in stock.

The immediate availability of packaged circuit amplifiers also makes short fast production runs an economical proposition. The Production Engineed is saved a considerable amount of tooling up and assembly time, while actual testing or fault finding on the amplifier circuit is eliminated, because each unit is guaranteed for 12 months and replacement units are supplied if any fault develops. Our guarantee also enables the manufacturer to guarantee his product to the ultimate user.

Specification Details

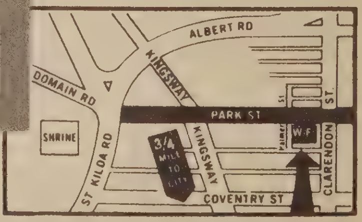
A typical miniature Audio Amplifier is illustrated above. Circuits are of transformerless, complementary symmetry type, operating off Standard Voltages. Can be wired-in or plug-in as required

PERFORMANCE DATA	PC1	PC2	PC3	PC4	PC5	PC7	PC9
Power Output mW	150	400	400	400	3W	800	Pre-amp
Input Sensitivity mV	50	1	5	150	5	5	1V
Input Impedance ohms	1.5K	1K	2.5K	220K	1.5K	1.5K	1M
Output Impedance ohms	40	15	15	15	3	8	600
Supply Voltage volts	9	9	9	9	12	9	9
Typical distortion %	2	3	3	3	3	3	1
Frequency response	300-15K	200-12K	200-12K	200-12K	50-12K	50-12K	20-20K
Overall Dimensions All ¾in. high	2 x 1	2½ x 1½	2½ x 1½	2½ x 1½	5½ x 1¾	3 x 1¾	2 x 1
PRICE	**$6.25**	**$7.50**	**$7.50**	**$7.50**	**$16.00**	**$9.50**	**$6.50**

PLEASE INCLUDE POSTAGE AND FREIGHT WITH ALL ORDERS

WARBURTON FRANKI

220 PARK STREET, SOUTH MELB., VIC. **69-0151**



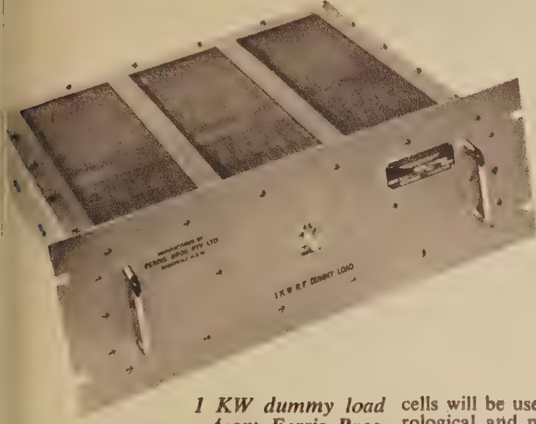
● *TRADE ALSO SUPPLIED*

WFE/5

TRADE RELEASES—IN BRIEF

FERRIS BROS. PTY. LTD. is in prouction with a 1KW RF dummy load and as provided the following specification for e unit.

GENERAL DESCRIPTION: Housed in fabricated metal case with woven wire esh covers on top and bottom. Mounted n a standard 19in x 4in unit panel for rack ounting. Case finished in dichromated dmium plate and front panel in satin hrome, engraved and filled. The resistive lement comprises 120 metal oxide film esistors arranged in a three bank series-arallel configuration. A small inductance n series with the input connector is used o compensate for the distributed capacity f the element.



1 KW dummy load from Ferris Bros.

LECTRICAL SPECIFICATION:

Nominal impedance —75 ohm non-inductive.
RF input connection —UHF S0.239 socket.
1/100 monitoring tap—BNC connector.
RF power — 1000 Watts maximum.
Frequency range — 2 to 30MC.

YPICAL ELECTRICAL CHARACTERSTICS (measured at ambient temperature).

Frequency	Impedance (ohms)
3MC	74 -j1.6
5MC	73 -j3.0
10MC	71 -j6.0
12MC	69 -j6.6
15MC	66 -j7.8
20MC	62 -j7.5
25MC	56 .-j6.5
30MC	52 -j3.8

The greatest VSWR occurs at 30MC and s approximately 1.45:1.

STABILITY: The resistance of the load tabilises after about five minutes' operation t 1000W.

RESISTANCE CHANGE: The resistance ncreases by 5 ohms from ambient to coninuous operating condition and recovers o its original value on cooling.

Further details are available from the ndustrial Division of Ferris Bros., located t 752 Pittwater Road, Brookvale, N.S.W.

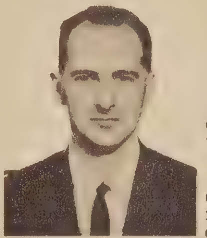
THE PLESSEY COMPONENTS ROUP, Dielectric and Magnetic Division, as introduced a range of integrated arrays f silicon photovoltaic cells designed to form round level solar energy converter power upplies.

The arrays provide a long-life, high relibility power supply requiring a minimum f servicing attention, which is particularly uitable for installations where access is ifficult. Extensive surveys have been comleted of the average yearly insolation incident solar energy) available throughout he world, and field trials have provided ata on arrays suitable for a wide range f power supply requirements.

To maintain continuous power output the rrays are designed to maintain the charge of nickel-cadmium storage batteries. A voltage regulator prevents the battery from reaching its dissociation potential, reducing electrolyte losses and consequent servicing requirements to an absolute minimum. Single array panels approximately 1 sq. ft. in area now available are capable of maintaining a battery supply of up to 50 mA at 12V indefinitely at favourable locations, and attention is likely to be required only once in four or five years, even in hot climates. Higher currents and voltages are accommodated by suitable interconnecttion of a number or array panels .

Corrosion is prevented by embedding the cells in epoxy resin under a glass panel, which is highly resistant to abrasion by wind-blown sand. This design gives almost unlimited array life, and ensures that the power supply can be expected to be substantially reliable and longer-lived than the equipment which it supplies.

Plessy anticipates the cells will be used in communications, meteorological and navigational equipment on remote sites. They say that while theoretically any power requirement can be met, practical considerations make the arrays most suitable for levels up to 10W continuous. (Details available from Ducon Condensers Pty. Ltd., P.O., Box 2, Villawood, N.S.W.).



THE DEPARTMENT OF SUPPLY has sent one of its officers, Mr David G. Meggs, overseas to continue an investigation into micro-electronics production. The investigation began in March, 1964, with the object of recommending the most effective and economical means of providing Commonwealth assistance to accelerate the establishment of micro-electronic production capacity in Australia. Mr Meggs left early in March for a three-month study of production processes in use and under development overseas. Visits will be paid to advanced electronics companies and government establishments in U.S.A., Britain and Europe.

AMALGAMATED WIRELESS VALVE CO. PTY. LTD., announces availability of a new series of "X"-Band reflex klystrons produced by English Electric Valve Co. to meet the expanding demand for relatively inexpensive, fully ruggedised local oscillators with a wide range of frequency temperature co-efficients.

Typical of the tubes included within this series is the K3003, which is electrically identical to its flying lead variant the K3020. Ideally suited for marine use, the excellent frequency drift characteristics of the K3003 are of particular note, having remained within a 10 MC variation during testing of over 3,000 hours. In addition to this, the peak frequency modulation of the tube is held to a specification maximum of 200KC under vibrational loadings of 10g.

A feature of this series of klystrons is the ability to choose one with a frequency/temperature coefficient suited to the particular application. The K3007, for example, has a co-efficient of —130KC/ degrees C, which is designed to match that exhibited by most commercially available 'X'-Band magnetrons. Coupled with this, a broad degree of manufacturing interchangeability exists between the new tubes, permitting the ready permutation of performance parameters to suit individual requirements for non-standard klystrons.

Further details are obtainable from AWV head office, 348 Victoria Road, Rydalmere N.S.W.

FOXALL INSTRUMENTS PTY. LTD. has announced availability of two complete pH instrumentation systems from their U.S.A. principals, The Foxboro Company. Both systems can be applied to large numbers of industrial processes for pH measurement and control, the company says. One system is a field-mounted solid-state pH measurement-transmitter system, featuring the new Model 699 pH-to-current converter. When connected directly to pH electrodes, the instrument is suitable for field mounting and transmits a 10-50mA signal over long distances to readout equipment.

The second system is also connected directly to pH electrodes, and uses a Dynalog instrument, which receives, indicates and records the pH measurement signal. The system can also be used for accurate control of pH.

A bulletin describing the two systems is obtainable from Foxall Instruments Pty. Ltd., 1213 High Street, Armadale, Melbourne, Victoria.

TEXAS INSTRUMENTS AUSTRALIA LTD. will sell in Australia a new micro-electronic connector made in the U.S.A. by Metals and Controls Inc., a division of the parent company, Texas Instruments Inc.

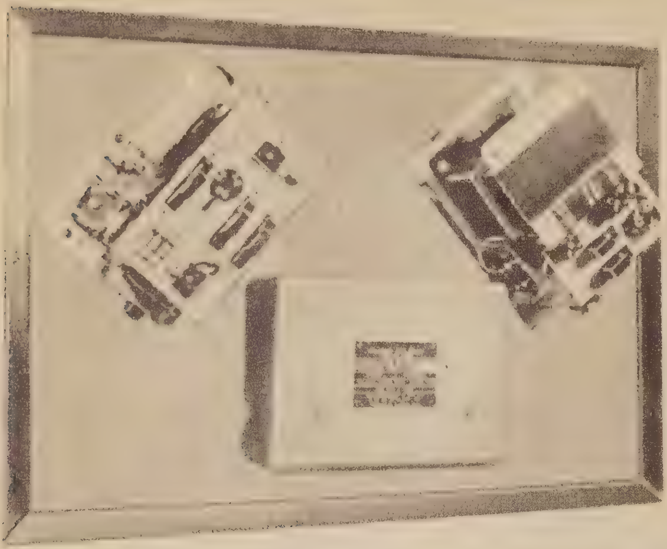
The device, Pin Pack Connector Model MPC4, allows interconnection of in-line or plug-in flatpack types of integrated circuits with up to 16 positions, for purposes of testing, prototype design and production packaging. Spring loaded connectors are used for reliability, with gold-plated beryllium copper helical springs permanently positioned in gold-plated brass housings. In addition to providing a reliable contact for multiple inserts, this type of socket prevents damage through the insertion of over-sized probes, and prevents solder fouling the contact springs.

A leaflet (catalogue page DD-ICP-7) is available from Texas Instruments Australia Ltd., Oldham Road, Elizabeth, S.A.

EMERSON AND CUMING, INC., of Canton, Massachusetts, U.S.A., has developed a system of rigid RF shielding which gives a performance in excess of Spec. 65-6 of the National Security Administration. Designated "Eccoshield NVO," the new shielding is erected from double-shielded panels. Staggered joint construction and other special design features contribute to high performance of the completed chamber. Excellent results have been obtained even around doors, where effective shielding is difficult, the makers claim.

Performance of the chamber exceeds specification NSA 65-6.

Australian agents are W. J. McLellan and Co. Pty. Ltd., The Crescent, Kingsgrove, N.S.W.



POWER RECTIFIER UNITS

(Regulated & Unregulated)

Trimax have developed, and manufacture a wide range of Power Rectifier Units both regulated and unregulated for use with telephone equipment. Output voltage 48V. with capacities from 400mA to 10A. Also static frequency changer units which produce 25c/s from 50c/s input.

Illustrated. Top left—Unregulated Power Supply—output 48V. 750mA.
Right—Frequency Changer output 75V., 20VA., 25c/s.

L M ERICSSON PTY. LTD.
"TRIMAX" DIVISION
FACTORY: CNR. WILLIAMS RD. & CHARLES ST., NORTH COBURG, VICTORIA. 'PHONE: 35-1203 . . . TELEGRAPHIC ADDRESS: "TRIMAX" MELB.

LM 5

Sure Brite Picture Tubes

ALL TYPES OF TUBES AVAILABLE EXCEPT BONDED

Year Warranty
$10 plus dud

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Second Quality
$8 (See below)

27 inch $20 plus dud
All prices cash or COD

THESE ARE
TRADE PRICES

FULL WARRANTY:
Any tube returned to Sure Brite under warranty is replaced with another one at no extra charge. regardless of whether it tests good or not, so long as it is not broken.

COUNTRY CUSTOMERS
Rail tubes to Lewisham Station, freight paid. Orders filled same day received. All freight charges to be paid by customer.

LARGE STOCK
We always have 200 to 400 tubes in stock. All Australian types except bonded. When ordering state which price tube you want, otherwise the $12 tube will be supplied.

DELIVERY
Free delivery on tubes Mon. Wed. Fri. inter suburbs only.

TEST TUBES
Some Second Quality Tubes at only $8.00

DUDS
Must be under vacuum and scratch free.
We can sell 17 inch without dud for $6 extra 21 inch without dud for $8 extra. 23" $10 extra.

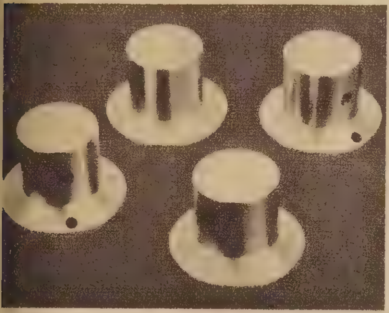
TUBES
We can supply tubes with 12 volt 300ma heater

Sure Brite Picture Tubes

22A VICTORIA STREET, LEWISHAM, SYDNEY, N.S.W. PHONE 56-6363

AUSTRALIAN GENERAL ELECTRIC TY. LTD. advise that they have available new range of improved high frequency licon controlled rectifiers designated C140 nd C141. Features of the new SCRs are iven as: 25KC operation; 400A/u-sec di/dt; 00V/u-sec dv/dt; 10 u-sec turn-off. A brohure with detailed specifications of the new CRs is obtainable on request, from the ompany's office at 103 York Street, Sydney.

ACME ENGINEERING CO. PTY. TD., of 132 Burwood Road, Burwood, 'ic. (Tel. 28-5511), are distributing directly nd through their interstate agents a new ne of aluminium control knobs for elecronic equipment — in particular for high delity audio systems. Manufactured in ustralia by Messrs Positronics, the knobs re machined from solid aluminium stock nd have a natural aluminium matte finish, 'as machined." This conforms well with he current trend to make hi-fi equipment ook more like an instrument and less like piece of furniture. The knobs, as picured, have a pleasing appearance and carry n indexing mark on the skirt to show conrol setting at a glance. The skirt is holowed out at the rear, to accommodate ush ends and nuts, so that the knobs can it close against the panel. Details of the ew range and prices can be obtained by vriting to Messrs Acme Engineering at the bove address.



CHANNEL MASTER has supplied deails of two new TV aerials. Type 1211 W/S is described as a wide-spaced 12-elenent in-line Yagi with the single driven olded dipole element as a three-conductor ype, and with boom braces. The aerial is lesigned primarily for deep fringe areas, and lifficult local areas. It is also suitable as a naster aerial for multiple and community ystems where one or more single channel Yagis are required. Retail price is $27.50 £13/15) including tax. Available as accesories are a two-bay stacking kit, price $6 £3) and four-bay stacking kit, price $37 £18/10).

Model 1011 is a 10-element in-line Yagi erial with folded dipole having a centre onductor (impedance bar). This is designed or fringe area reception of Channel 11. For leep fringe areas, it can be arranged as a wo- or four-bay array. Retail price is $18 £9). Prices of stacking kits are the same as hose given above for the Type 1211 W/S.

Trade inquiries for these aerials should be ddressed to Ferris Bros. Pty. Ltd., 752 Pittwater Road, Brookvale, N.S.W.

THE PLESSEY GROUP in Australia is ow organised in five products groups, conisting of Automation, Components, Dynanics, Electronics and Telecommunications. The various companies of the group, in ddition to the holding company Plessey Pacific Pty. Ltd., are as follows:

Plessey Automation: Ericsson Telephone Aust.) Pty. Ltd.; British Automatic Telehone and Electric Pty. Ltd.

Plessey Components: Ducon Industries Ltd.; United Capacitor Co. Pty. Ltd.; Rola Company (Aust.) Pty. Ltd.; Garrard Enginering Company (Aust.) Pty. Ltd.

Plessey Telecommunications: Telephone and Electrical Industries Pty. Ltd.; Communication Systems of Australia Pty. Ltd.

Plessey Dynamics and Plessey Electronics are two new groups which have been formed during the last year.

The parent company in U.K. recently acquired the Ground Radar and Data Handling Division of Decca Radar Ltd. Both these Divisions have important links in Australia, the company says.

SOANOR ELECTRONICS PTY. LTD., of 15 Conder Street, Burwood, N.S.W. (tel. 74-3444), anounce that they have now taken over the stocks of A and R transformers, formerly held by the previous agent, Watkin Wynne Pty. Ltd. In addition, they are stocking a wide range of electrolytic capacitors, selenium bridge rectifiers, silicon diodes and PVC adhesive electrical tapes.

RONALD J. T. PAYNE PTY. LTD. claim that the new Midwestern Instruments Model 1200 optical recording oscillograph has features which yield a basic performance comparable with similar instruments costing more than twice as much. These features include 12in paper width, 475-foot capacity, paper speeds up to 150in per second and up to 150 active data channels.

The basic Model 1200 occupies only 8¾in of standard EMA rack space and provides optional features including variable channel capacity, multiple speed ranges, mercury vapour or xenon recording lamps, flash timing, trace numbering, record identification and automatic record length control. The instrument will accommodate all Midwestern optical galvanometers with flat frequency responses ranging from 24 to 15,000cps. (Ronald J. T. Payne Pty. Ltd., 385 Bridge Road, Richmond, Victoria.)

DUCON CONDENSER PTY. LTD. has been granted Quality Control Board Part 1 Approval by the Director of Quality Control of the R.A.A.F. The arrangement allows Ducon to undertake approval testing on behalf of the Department of Supply on a wide range of Ducon electronic components. Ducon's official approval reference number is Q.C.B. 1091/64.

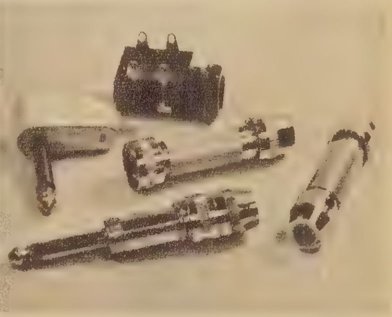
AMALGAMATED WIRELESS VALVE CO. PTY. LTD. has released information on a new ceramic tetrode with integral boiler manufactured by the English Electric Valve Co. Ltd. This is said to be the first commercial ceramic tetrode with integral vapour cooling system, and the makers claim that the combination of ceramic construction with the recently developed method of built-in vapour cooling offers the user the advantages of both types of construction. Ceramic provides for more robust construction, higher reliability, increased operating frequency and higher temperature processing; integral cooling allows higher maximum anode dissipation, space saving, lower initial cost and simple external cooling service, and also contributes to increased reliability.

The new tetrode, CY1170J, will deliver an output power of 82.5KW under class C unmodulated conditions and will operate at full ratings up to 30MC. It is intended for use in audio amplifiers, linear amplifiers, class C amplifiers and oscillators.

Also from AWV comes news of new inexpensive "low profile" silicon controlled rectifiers capable of delivering up to 7 amps RMS. The company anticipates that the new SCRs, types 40378 and 40379, will find particular application in electric tools, appliances, light dimmers, portable electric heaters and other items where high forward current and a low profile package are desirable. For example, the compact size will allow stepless speed control and adjustable torque control to be fitted into existing designs without extensive modifications — in the handles for example.

A leaflet and full details are available on request to Amalgamated Wireless Valve Co. Pty. Ltd., Private Mail Bag, Ermington, N.S.W.

LEO ROGALY AND LEWIS PTY. LTD. advise that British-made Metrosound audio accessories are available through normal trade channels. Illustrated here are three of the Metrosound items. The top picture shows the "Metrostrobe," a stroboscope for checking the speed of tape recorder transport mechanisms. A loop of the moving tape is passed through the drum, causing it to rotate. The strobe disc will show whether the speed is right, fast or slow, when viewed in artificial light operated form 50 or 60cps supplies. The items in the lower picture are the "Metro-Mat" which discharges static from records when placed on the turntable; and a stylus cleaning kit consisting of a special cleaning fluid and brush.



TAPE RECORDERS PTY. LTD., of 60 Clarence Street, Sydney, has available a range of jack plugs and sockets made by the British company Rendar Instruments Ltd. Plugs can be supplied as screened or unscreened types, two or three-contact, with top or side entry. Cable connectors are also available, for screened or unscreened cable. Most items in the Rendar range can be supplied with screw locking fitment, so that leads cannot be accidentally disconnected. Inquiries for supply of these items should be directed to normal trade outlets, but a descriptive leaflet and prices can be obtained by writing to Tape Recorders Pty. Ltd. at the address given above.

A. AMPLIFICATION
C. COMMUNICATION
E. ELECTRONICS

★★★★★★★★★★★★★★★★★★★★★★★PHONE 51-3845

RADIO

636 KING STREET, NEWTOWN—51-7008

136 VICTORIA ROAD, MARRICKVILLE — 51-3845

B.S.R.

4-TRACK DECK
$35.50 £17/15/-
2-Track, 3-Speed.
$35.50 £17/15/-
4-Track, 3-Speed. Mono or Stereo.
$45.25 £22/12/6
4-TRACK. 3-SPEED.
3 HEADS.
$49.50 £24/15/-

BRADMATIC HEADS
Latest ½-Track. Hi Fi.
$9.50 £4/15/- pair

4-TRACK or STEREO
Record play back $11.50
erase $5.50

THE NEW COLLARO TAPE DECK

Takes 7in spool.
3 speeds: 1⅞, 3¾, 7½ i.p.s.
2-track, $44.
4-track, $48.
Write for particulars.

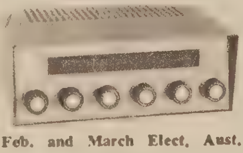
TRANSISTOR POWER SUPPLIES

12v. D.C. Input. 300v. 150Ma. Output plus 150v. Output.
$23.75 £11/17/6
12v. D.C. Input. 400v. 150Ma. Output plus 200v. Output.
$29.75 £14/17/6
240v. A.C. INPUT
9v 200 MA **$4.75**
12-15-22v 500 MA **$7.75**

VARY. A.C.S.

240-270V 50 cycle 5 amp.
Provide infinitely variable AC voltage
$29.50 £14/15/-
2½ Amp as above
$23.50 £11/15/-
10 amp. as above.
$45.75

PLAYMASTER 106 AND 107



Feb. and March Elect. Aust.
106
WIRED AND TESTED. **$88.75**
107
WIRED AND TESTED. **$79.00**

ELECTRIC GUITAR

Pickup Units	$8.75
Accordion Pickup Units	$8.75
Harmonica Pickup Units	$1.95

Post., N.S.W. 40c; Interstate. 75c.

TRIO W26 STEREO-TUNER AMPLIFIER

12 watts per channel.
Mag. P.U., Crystal P.U., Tape In-Out, Broadcast, Stereo, S.W. Mono.
$138.00 __ __ __ £69
SEE TRIO. ADVERT.

Transistor-Ignition HI-SPARK

Simple installation.
38 K.V. output.
Complete. Tested.
Negative earth.
$33.50 £16/15/.
Positive earth.
$41.50 £20/15/-
State voltage and polarity.
Post., N.S.W., 75c; Interstate, $1.25.

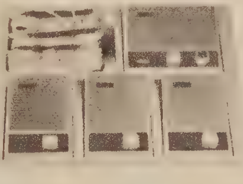
CITIZENS BAND

27.240 Megs.
10 Transistor Transceivers.
100 M.W. output.
$45.00

1 watt. 15 transistor, with squelch provision for two channels. Range to 10 miles under ideal conditions.
$80.00 £40 each

INTER. COM. UNITS

2 Station Transistorised
$11.50 £5/15/-
4 Station, including Master
$20.25 £10/2/6



New Telephone Amplifier

Transistorised.
$11.50 £5/15/-
Post 35c.

T.V. TUNERS

New 10-channel Tuners.
$15.00 £7/10/.
Post 75c.

LATEST 4-SPEED PLAYERS

240V A.C. Mono	$11.50
240 A.C. Stereo	$17.00
Battery Mono	$19.50
Battery Stereo	$21.50
Battery Mono 45 r.p.m. in Cabinet	$9.25

Post., N.S.W., 75c; Interstate, $1.25.

Send for full details on Radiogram Chassis, TV and Amplifiers.

AMPLIFIERS

Public Address Range
240V-AC

MINIATURE P.A. AMPLIFIER.
15 WATTS OUTPUT.

Multi Match Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing. P.P. EL.84 output	$39.50
30 Watt. As above EL34 P.P.	$53.50
40 Watt. As above EL34 P.P	$79.50
60 Watt. As above EL34 P.P.	$98.50

LINE OR VOICE COIL TRANSFORMERS.
MULLARD HI-FI RANGE.

5/10 with pre amp base and treble boost. Ultra Linear output	$43.50
5/20in. As above	$65.50

BATTERY-AC OPERATION

6 valve 6v plus 240v-10 watt	$55.50
7 valve 12v plus 240v-12 watt	$59.75
7 valve 12v plus 240v-25 watt	$71.75

TRANSISTOR P.A. AMPLIFIER C.A.-512

12VDC Operation.
Output 20 watts.
Current consumption at max. output, 2.2 amps.
Input. High imp. mic. Also 600 ohms and tape.
Independent gain controls.
Output: Imp. 4-8-16 ohms.
Freq. Response:
200 cps—6000 cps.
Dimensions: 2in x 6¼in x 8½in.
Complete with instruction book with circuit. All plugs.
PRICE $57.50

DYNAMIC MICROPHONES

DM-391 HI-Imp	$3.50
DM-175 HI-Imp	$4.75
DMS-3 HI-Imp	$5.50
DM-305. 600 ohms or HI-Imp. Suitable stand mounting	$9.75
DM-304. Dynamic Cardioid. 50 ohms or HI-Imp. Suitable stand mounting	$15.75
D.M. 307 HI-IMP.	£7/10/-
CM-10 Crystal HI-Imp. Suit stand mount.	$5.06

Post., N.S.W., 25c; Interstate, 35c.

WIDE RANGE LIGHTWEIGHT STEREO PICK-UPS

Ceramic Units, Sapphire Styli	$7.0
Diamond Styli	$10.5
Universal Ceramic Stereo Cartridge, Sapphire Styli	$2.9
Diamond Styli	$6.5

NEW WIDE RANGE SPEAKERS

15 ohm. Twin Cone

8in	$7.0
12in	$7.9
5in	$4.5
5in Tweeter	$3.7
4in Single Tweeter	$2.7
12in Heavy Duty 20 watt	$15.5

P.A. REFLEX HORNS

WITH UNITS

5 Watt 8 ohm	$14.5
10 Watt 8 ohm	$26.5
35 Watt 15 ohm	$18.0

N.B.: As these are American ratings divide the wattage by 2.

STEREO RECORD CHANGERS

1965 model. 4-speed.
$21.50 £10/15/-
De Luxe Model.
Fully machined and balanced Heavyweight turntable. Ceramic cartridge.
$27.50 £13/15/-
Post. N.S.W., $1.25; Interstate, $1.7

STEREOPHONIC HI-FI HEADPHONES

With padded earpieces
SPECIFICATION:
Frequency Response: 25-17,000 cp
Nominal Power 1 watt.
V.C. Imp. 8 ohms each channe
$7.75 £3/17/6
Post., 50c.

PHILIPS DISC JOCKEY

4-speed Players.
6V, D.C. OPERATION.
MONAURAL CRYSTAL HEAD
$9.75 £4/17/6
STEREO
$11.75 £5/17/6
Post., N.S.W., 75c; Interstate. $1.25

MORSE KEYS

New lightweight, fully adjustable unit
95c
As above with buzzer.
Complete Morse practice set.
$1.65

A. AMPLIFICATION
C. COMMUNICATION
E. ELECTRONICS

★★★★★★★★★★★★★★★★★★★★ PHONE 51-3845

RADIO

636 KING STREET, NEWTOWN—51-7008

136 VICTORIA ROAD, MARRICKVILLE — 51-3845

GUITAR AMPLIFIERS

10-Watt, Two Channel, with Twin Cone Speaker, $51.50 (£25/15/).

14-Watt, 4 Inputs, Bass and Treble Boost. 2 Twin Cone Speakers, $59.50 (£29/15/).

17-Watt. Four-Channel. Bass and Treble Boost. Two Twin Cone Speakers, $73.75 (£36/17/6).

35 WATT

4-Channel, Bass and Treble Boost. 4 Twin Cone Speakers, $105 (£52/10/).

60-Watt, 2 Unit
4-12in Auditorium Speakers,

$171.75 £85/17/6

Vibrato with foot control and 2 pre-set controls for frequency and intensity. $10.56 (£5/5/) extra on above models.

14 plus 14 WATT

With Reverberation. May be used as 28 Watt or as 14 Watt plus 14 Watt Reverb. Two 9 x 6 Woofer Speakers. Two 9 x 6 Twin-Cone Speakers. 4 Channels, Bass and Treble Boost. Foot Vibrato Control included.

$163.50 £81/15/-

SLAP BASS OR BASS GUITAR 40 WATT AMPLIFIER

4 Input Channels. Bass and Treble Boost. Two 12in Radial Beam Speakers. Perfect reproduction on 20 cycles.

$145.75 £72/17/6

PIGGY BACK GUITAR AMPLIFIER

30 Watt	$79.75
45 Watt	$99.75
60 Watt	$119.75

4 Inputs. Base and Treble Boost. Vibrato if required. $10.50 extra.

TAPE ECHO UNIT

Sui's and Guitar amp.
without any altera.ion.
JUST PLUG IN

$139.50

REVERBERATION PRE AMPLIFIER

Suits any Guitar amp.
No changes necessary.
JUST PLUG IN
Completely transistorised.

$58.75

PLAYMASTER 4 STEREO AMPLIFIERS

Push-Pull. 8 Watt per Channel. Bass and Treble boost and Cut.
Wired and Tested.

£38/10/- $77.00

TRANSISTOR CAR RADIO

Push-button operation. High sensitivity. Tailored to fit most modern cars. 6v or 12v operation — state voltage. Polarity and speaker size.

$58.00 £29 Complete

NEW RECORDING TAPE

	£	s	d
3in. Mylar LP 300ft. ..		10	6
5in. Mylar LP 900ft. ..	1	0	0
5in. Mylar DP 1200ft. ..	1	5	0
5¾in. Mylar LP 1200ft. ..	1	5	0
5¾in. Mylar DP 1800 ..	1	17	6
7in. P.V.C. 1200ft. ..	1	5	0
7in. Mylar LP 1800ft. ..	1	17	6
7in. Mylar DP 2400ft. ..	2	10	0
10½in. Mylar LP 3600ft. .	3	15	0

Post 2/6 per Spool.

P.A. SPEAKERS
8 WATT

6in Units in Waterproof
Projection Horns.
15 Ohm Voice Coils.

$13.50 £6/15/-

In Double Ended Flares.
Duolateral Coverage.

$14.50 £7/5/-

Line Output Transformers to suit. $1.75 (17/6) extra.

P.A. SPEAKER DRIVER UNITS

American Rating. 30 Watts.
Voice Coil 16 ohm.

$21.50 £10/15/-

15 Watt Rating.

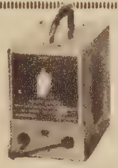
$15.75 £7/17/6

REFLEX HORNS TO SUIT.

$21.50 £10/15/-

WEEKEND — HOLIDAY — EVENING DEMONSTRATIONS AT COLLAROY

PHONE XW5956 FOR APPOINTMENT TO TEST STEREO GUITAR AMPLIFIERS AND TELEVISION.



BATTERY CHARGER

240 Volt A.C. Operation

3 Rate 6V, 12V TRICKLE CHARGE

Trickle Charge Position suits all Batteries. 2V to 12V at rate of 200 to 500 M.A.

STANDARD

2 amp. 6V, 12V, TRC ..	$11.50
3 amp. 6V, 12V, TRC ..	$12.25
4 amp. 6V, 12V, TRC .	$15.25
5 amp. 6V, 12V	$15.95

Post., N.S.W. 75c, Interstate $1.25

DE LUXE

1½ amp., 6V-12V	$9.75
3 amp.	$16.75
4 amp.	$19.75
6 amp.	$21.75
10 amp.	$27.75

Rail or Air Freight on.

Complete $28.50

PLAYMASTER BOOK SHELF UNITS

To R, TV & H specifications.
Mountain Ash, Maple, Walnut or Teak Formica finish.

ALSO CABINETS ONLY

To suit 6",	8" and	12" speakers
$12.50	$15.50	$17.50

REVERBERATION UNITS

Latest design to suit organs, stereo, guitar, any hi-fi equipment.

£2/17/6 $5.75

Post. 3/6.

ELEGA REVERB. SPEAKERS

Automatic addition of reverberation to any existing amplifier.
Handles 12 watts.

£12/15/- $25.50

CO-AXIAL SPEAKERS
C.S-30. 12"

V.C. 16 ohm. Cross over 3,000 cycle. Frequency range 30 to 20,000 cycles. Rated 20 watts.

£13/19/6 $27.95

C.S-20. 8"

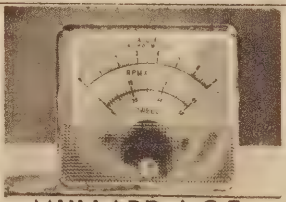
V.C. 16 ohm. Cross over.
3,000 cycle. Frequency
Range 40 to 20,000 cycles.
Rated 8 watts.

£7/19/6 $15.95

HORN TWEETER
CT-3

2,000-20,000 Response.
20 Watts Power.
Sensitivity 110 dbw.
Weight 1¼lb.

£4/9/6 $8.95



MULLARD-A.C.E. TACHOMETER

Wired and tested.

$20.75 £10/7/6

"Electronics Australia," July, August issue. State max. revs., voltage, polarity cylinders.

METER ONLY

$6.75 £3/7/6

INCLUDING DWELL. ANGLE FACILITY

$23.25 £11/12/6

Post., N.S.W., 50c; Interstate, 75c.

AMPLIFICATION

A.

COMMUNICATION

C.

ELECTRONICS

E.

★★★★★★★★★★★★★★★★★★★★★PHONE 51-3845

RADIO

636 KING STREET, NEWTOWN—51-7008

K 20 CT330

K 20 CT500

220S 4000 O.P.V.

D.C. Volts 5, 25, 125, 500, 2500. A.C. Volts 10, 50, 250, 1000. Current: 250uA. 250mA. Resistance: 0-10K, 0.1 Meg.

£3/19/6 Post 5/-

C.T.330 20K.OPV

D.C. Volts, 6, 6, 30, 120, 600, 1200, 3000, 6000. A.C. Volts, 6, 30, 120, 600, 1200. D.C. Current, .06-6, 60, 600mA. Resistance, 6K, 600K, 6meg. 60meg. D.B. minus 20 to plus 62. 5 Ranges. Specially suitable for transistor use. **$15.95** Post., 50c.

C.T.500 20K.OPV

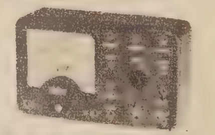
D.C. Volts, 2.5, 10, 50, 250, 500, 1000. A.C. Volts, 10, 50, 250, 500, 1000. D.C. Current, .05, 5.50, 500mA. Resistance, 12K, 120K, 1.2 meg., 12meg. D.B. minus 20 to plus 62.

$13.25 Post., 50c.

S.E.550 100K.OPV

D.C. Volts, .5, 2.5, 10, 50, 500, 1000. A.C. Volts, 2.5, 10, 50, 250, 1000. D.C. Current, 10uA, 2.5, 25, 250mA, 10 amps. Resistance, 2K, 200K, 2M, 20M. D.B., minus 20 to plus 62.

$20.75 Post., 75c.



P.T.34 1000.OPV

D.C. Volts, 0, 10, 50, 250, 500, 1000.
A.C. Volts, 0, 10, 50, 250, 500 1000.
M.A. 1-100-500 RESISTANCE.

$5.25 Post., 50c.

200H. 20K.OPV

D.C. Volts, 5, 25, 50, 250, 500, 2500. A.C. Volts, 10, 50, 100, 500, 1000. D.C. Current, 50uA, 2.5, 250mA. Resistance, 6K, 600K. Capacitance, 2 D.B. Ranges.

$10.50 Post., 50c.

ALL PRICES NET, INC. S.-TAX.

V.T.V.M.

27 Ranges. A.C. Powered.
D.C.V. 0, 1.5, 5, 15, 50, 150, 500, 1,500.
A.C.V. 0.1.5, 5, 15, 50, 150, 500, 1,500 R.M.S.
A.C.V. P. to P. 0, 1.4, 4, 14, 40, 140, 400, 1,400, 4,000.
Resistance, 1 ohm to 1,000 megohm.
D.B. Minus 10 D.B. to plus 65 D.B.

$42.50

Post., $1.
H.V. Probe to 30 KV. $7.75.
T.M.K. Units, $53.50.

TEST EQUIPMENT

WIDE BAND OSCILLOSCOPE

5 Meg. Bandwidth. Push-pull vertical and horizontal Amplifiers. 8 position, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard-time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

3-inch $99.75; 5-inch $111.50

4 CHANNEL MICROPHONE MIXER PRE AMPLIFIER

$7.75

Post., 50c.

TRANSISTORISED VARIABLE POWER SUPPLY

Range to 20V, 200MA

$18.75

Post., 50c.

G.D.O. UNITS

Leader, 810, 6-Band, 2 Meg. to 260 Meg. Nuvistorised. 240 V.A.C. Operation, Modulated. Calibration. Accuracy 2 per cent.

$41.50

T.E. 18 Lafayette, 8 Bands, 360 K.C. to 260 Megs. 240 V.A.C. operation.

$39.50

Post., N.S.W., 50c; Interstate, 75c.

MINILAB 7in 1 MULTIMETER

$16.75

Post, 50c.

STEREO PRE AMPLIFIER

240 V. A.C. Power.
To suit magnetic P.U. tape or microphone.
Response: 20 to 20,000 cycles.
Gain 60 D.B.

$15.50

Post., 50c.

LEADER SWEEP & MARKER GENERATOR

TV and F.M. 2 to 270 Megs. 5.5 Meg. Crystal for TV sound. Sweep width to 12 Megs. Model 531.

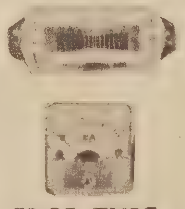
$139.00 £69/10/-

Model 532

$170 .00 £85/-/-

Post., N.S.W. $1.50; Interstate, $2.50

PANEL METERS



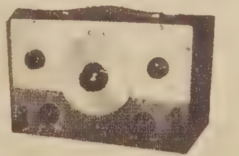
EDGE TYPE

1 mM. Scaled. S. Meter. Stereo Balance. Tuning. **$2.50**

2" 3" 4" PLASTIC COVERED PANEL UNITS

Latest P series ¾in Barrel 50mmA, 200mmA. 1mA, 10 mA, 500mA, 1 Amp, 10 Amp, 15V, 500V.

From $3.00



T.E. 20 RF SIGNAL GENERATOR

Freq. 120KC—260MCS in 6 bands.
Output (RF)—High 100,000uV max. Low 100uV max.
Output (Audio)—400 cps approx. 8V.
Modulation — 400 cps internal.
Operation — 240V AC.
Dimensions 7in x 10½in x 5½in.
Weight — 9lb.
Complete with Instruction Book circuit.

$26.50 £13/5/-

T.E. 20D, sig and marker gen. 120KC to 500 megs.
With 5.5 meg. crystal.

$39.50

Post., N.S.W., 75c; Interstate, $1.25.

LEADER SIGNAL GENERATOR LSG 11

240v A.C. Powered.
6 Band, 120 Kc to 390 Megs.
Provision for Crystal.
An Ideal TV Marker Generator.

$29.50

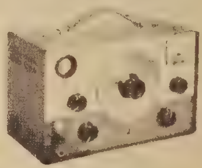
Post., N.S.W., 75c; Interstate, $1.25.

SIGNAL INJECTOR

Transistorised. Fountain Pen-sized Unit for Signal Tracer in Radio TV and Amplifier Service.

$4.75

Post., 25c.



T.E.46 RESISTANCE-CAPACITANCE

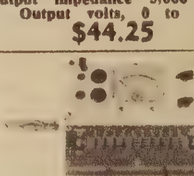
Bridge and Analyser.
Capacity 20 pfd to 2,000 mfd.
Resistance 2 ohm to 200 megs.
Also tests power, factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs. at 600V.
Indications by eye and meter.

$51.95

T.E.22 AUDIO GENERATOR

Sine and Square Wave.
20 Cycles to 200 K.C. 4 Bands.
Frequency response plus/minus 1.5 D.B.
60 Cycles to 150 K.C.
Output impedance 5,000 ohm.
Output volts, 0 to 7.

$44.25



VALVE TESTER

Tests all valves, diodes, rectifiers, checking filaments, shorts. Merit on direct reading. Good-bad meter. Complete with tube chart.

$26.75

Post., N.S.W., 25c; Interstate, $1.25.

T.E. 50.—99—5011

Checks, Nu Vistas, Compactrons, etc.

$34.25

★★★★★★★★★★★★★★★★★★★★★★PHONE 51-3845

A.C.E. RADIO

AMPLIFICATION
COMMUNICATION
ELECTRONICS

136 VICTORIA ROAD, MARRICKVILLE, SYDNEY,
AND 636 KING STREET, NEWTOWN—51-7008

EVENINGS and WEEKENDS: "KALUA," Hilma Street, Collaroy Plateau, XW5956
DULWICH HILL, EARLWOOD, BUS STOPS AT DOOR, STOP No. 42

NEW
HOME LIGHT BATTERY
CLYDE OR DUNLOP
19 Plate. 150 Amp.
Dry Charged. Cells.

$3.25 £1/12/6 ea.

A.C. D.C. MOTORS
32V and 110V.
High Speed, Series Wound.
1/8 h.p. motors.

$3.75 £1/17/6

Post N.S.W. 75c, Interstate $1.25.

NEW VALVES

1A3	75c	12SK7	50c
1A5	75c	12SL7	$1.25
1C5	75c	47	$1.25
1C6	$1.25	76	75c
1C7	50c	84/624	$1.25
1D5	55c	304TH	$3.00
1F5	$1.00	723A	$6.00
1G4	75c	807	$2.00
1H5	75c	809	$1.75
1H4	75c	813	$7.00
1J6	$1.25	829B and	
1K7	50c	Socket	$5.75
1L4	50c	866A	$1.50
1M5	50c	954	50c
1N5	75c	1603	50c
1Q5	50c	1616	75c
1T4	$1.00	1619	$2.00
6AR6	$1.25	1629	50c
6AN7	$1.00	1050	$2.00
6AS7	$1.00	9006	50c
6B6	75c	AV11	25c
6B8	75c	CA19	$10.50
6BF6	$1.00	CK1013	$1.50
6BL8	75c	CV63	75c
6BM8	75c	CV66	75c
6C8	75c	CV1102	75c
6F6	$1.00	CV1133	75c
6G6	75c	CV1136	75c
6J6	75c	EBC33	75c
6J6	$1.00	EC70	40c
6J7G	75c	ECH33	$1.50
6K6	75c	EF36	75c
6K7	50c	EF37	75c
6N7	75c	EF39	75c
6SA7 Metal	75c	EF72	40c
6SC7	$1.00	EF73	40c
6SF7	$1.00	EK32	$1.50
6SG7	$1.00	EL91	$1.00
6SH7	40c	KTW62/	
6SJ7	95c	6U7	75c
6SK7	$1.25	RL27	$1.50
6SN7	75c	RK34	75c
6SS7	$1.25	RK75	$1.00
6X5	75c	RK84A	$6.00
7C5	50c	VR65	50c
7N7	75c	VR75/30	$1.50
7W7	50c	VR105/30	$1.50
12A6	50c	VR150/30	$1.50
12AT7	$1.00	VT502	$1.25
12BE6	$1.00	32	$1.00
12BH7	75c	42	$1.00
12C8	$1.25	45	$1.00
12SJ7	$1.25	37	$1.00
2A3	$2.00	49	$1.00
2C26	75c	53	$1.00
2X2-879	50c	59	$1.25
3A4	$1.25	63	$1.00
3B7	$1.00	89	$1.00
3D6	$1.00	77	$1.00
5X4	$1.00	2V3	75c
5Z4	$1.00	CL4	$1.25
6AC7	75c	EM1	$1.25
6AG5	95c	TZ40	$1.00
6AG7	$1.00	6AB7	75c
6AJ5	50c	6C6	$1.25
6AK5	$1.00	6F7	$1.25
6AL5	75c	6SC7	75c
6AM5	75c	7A6	75c
6AM6	75c	9006	50c
6AN5	$1.25		

GENEMOTORS

Input	Output			
12v	600v	300mA	New	$11.00
12v	500v	350mA		$17.00
12v	1200v	200mA		$13.00
24v	250v	100mA	New	$4.00
24v	540v	200mA	New	$4.00
24v	300v	250mA	New	$5.50
12v	275v	110mA		$7.50

CHASSIS PUNCHES
SIZES ⅝", ¾", ⅞", 1".
1⅛" with tapered
Reamer and Carry Box.

$5.75 £2/17/6

Post 50c, Interstate $1.00.

NEW POWER TRANSFORMERS

1960 5in CRO	$11.75
325 x 325 150MA	$9.50
285 x 285 300 MA	$14.70
800V and 270V 300MA	$15.00
240V-110V 1.3KVA Auto	$21.00
150 x 150V 30 MA	$2.75
225 x 225V 40 MA	$3.00
124V Doubler 300MA	$6.75
130V Doubler 400 MA	$7.75
145V Doubler 450 MA	$9.75
150V Doubler 500 MA	$10.75
220V Doubler 600 MA	$14.70
310 x 310 170 MA	$4.95

3" SELSYN MOTORS—TRANSMITTERS
50 V AC — 50 cps.

$5.75 £2/17/6

Post 75c, Interstate $1.00.

RELAYS

6V, 3-pole Miniature	$1.50
12 volts, DPDT, 5 amp	$2.00
12 volts DPDT	$1.25
100pf TX var. condensers	$1.00
Hi-speed Polarised relay	$5.00

PMG TYPE 3000
2000 ohms, $1.25
1000 ohms, $1.25

Lapel Crystal Mikes	$1.25
C-ystal Mikes with switch	$1.50
Telephone Pick-up Units	$1.25
Contact Pick-up Units	$1.50
100UA Stereo Bal Meters	$3.50

OIL FILLED CONDENSERS

.5mfd 600V	35c
2mfd 600V	65c
1mfd 600V	65c
4mfd 600V	65c
4mfd 2.5K	$3.00
1mfd 3000V	$1.70
.5mfd 5K, .1 5K, .1 3K AC	
.25 4K, .5 2½K ea.	$1.50
4mfd 3000	$3.50
2mfd 3000	$2.50
1 mfd 3000	$2.00
1.25 mfd. 6000v.	$4.50
mfd. 4000v	$3.00
2 mfd. 2000v	$1.50
4 mfd. 1500v.	$1.50
1 mfd. 1500v.	$1.00
8 mfd. 600v.	$1.00
1 mfd. 1000v.	$1.00

PYE REPORTER
2-way Vehicle Band Transceivers.
Ex-Taxi Cabs.
12 volt, 70 meg. Complete with valves and speaker.

$33.75 £16/17/6

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3API-906 3in	$2.75
CV112 5in	$2.00
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ACR10/VCR139A 3in	$3.00
CV1522 1¾in	$2.25

6" INDICATOR UNITS
TYPE 1A
Suitable for C.R.O. conversion.
Circuit supplied.

$20.75 £10/7/6

NEW 3-GANG CONDENSERS
300 PF + 200 PF + 60 PF

75c 7/6

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5 Ohm	$2.25
2000 Ohm	$2.25
4000 Ohm	$2.50
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Australian DLR	$1.25
Dynamig Earpieces, pr.	45c

Post 25c pr.

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18" Goose neck complete with shade. 3-core flex, plug and switch. Ideal for machine light, music light, reading lamp, table or TV light.

$1.05

Less shade 75c. Pack. and post., N.S.W., 75c; interstate $1.05.

WANTED
Communications Receivers. Test equipment. P.A. Gear. Large or small surplus stock. Best prices. Call, write or phone, any time.

TRANSISTORS

MT-71-OC71	75c
2N174	$5.00
2N442	$4.50
2N441	$4.00

High-powered units for 75-watt audio, 200-watt power units or transistor ignition.

T.B.Y. TRANSCEIVERS
20 to 80 Megs. Battery Operated.
4 Band units. Variable tuning.

$29.75 £14/17/6

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$39.75 £19/17/6

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2 speed. Reversible.
Capacitor Start.
Double ended drive.
Ball bearings.

$5.50 £2/15/-

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Square. Clear Plastic.

2¼in 50 UA	$4.75
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3⅜in 1mA	4.75
2¼in 500V. A.C.	$4.25
2¼in 500V. D.C.	$3.50
3⅜in 500V. A.C.	$5.75
3⅜in 500V. D.C.	$5.00

Post N.S.W. 25c, Interstate 40c.

INTER COM TELEPHONES
15 Line Connections.

$7 £3/10/- each

PILLOW PHONES
Low Imp. VC Matchings.
Ideal Hospitals, etc.

$1.75 17/6 each

COMMUNICATIONS RECEIVERS

B.28—CR100
Current Navy Receiver.
6 Band .40 K.C. to 32 Meg.
Variable Selectivity. 2 R.F.
2 I.F. Stages. Crystal Gate Band Spread. New condition. Air-tested.
Realigned 240V A.C. operation.

$130.00 £65/-/-

AR7 RECEIVERS
Air-tested, realigned. Perfect order.

$115.00 £57/10/-

MECHANICAL FILTER
For SSB Receivers.
455 KC. Balanced or unbalanced as required.

$33.75 £16/17/6 Post 50c.

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AIR TESTED. PERFECT ORDER.
6v. Operation. 6 Band.
200 K.C. to 30 Megs.
Ideal communications Receiver or mobile and small ships' use.

$55.00 £27/10/-

3BZ TRANSMITTERS
12V Operation. 15 Watt O.P.
2 to 9 Megs.
Air Tested. Perfect order.
Suit small ships, Bush Fire Brigades, Island Services.

$55.00 £27/10/-

522 TRANSCEIVERS
Complete With Valves.
100 to 156 Megs.

$25.75 £12/17/6

522 TRANSMITTERS
Complete With Valves.

$13.50 £6/15/-

522 RECEIVERS
Complete With Valves.

$11.50 £5/15/-

NEW ROTARY CONVERTERS
160 watt, 50 Cycle.
24v to 32v input.
Output can be supplied for 50-110 or 240v as required.
Suit radiograms, TV, Tape Recorders, Fluorescent Lights.

$39.75 £19/17/6

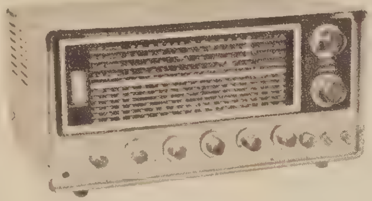
450 Watt, as above.

$73.75 £36/17/6

PHILIPS No. 4
COMMUNICATION RECEIVERS
6V Operation, 500 KC to 18 megs.

$45.75 £22/17/6

LAFAYETTE *Latest Range of*
1966 Model SWL and Communications Receivers



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An Improved Version of the Popular HE-30.

- 4 Bands 550 KC to 30 MC (Includes Broadcast Band).
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- Built-in Q-Multiplier for Crowded Phone Operation.
- Effective Automatic Noise Limiter.
- Built-in Edgewise S-Meter.
- Calibrated Electrical Bandspread on Amateur Bands 80 to 10 Metres.

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HA-225 14-TUBE SSB/CW/AM

Amateur Receiver With Dual Conversion On Six Metres.

- 5 Bands 150-400KC, 1.6-30MC, 48-54MC.
- Constant Filament Voltage on Mixer and Oscillator Stages Gives Superior Frequency Stability.
- New Product Detector for Improved SSB Reception.
- Crystal Calibrator for Checking Calibrations (Crystal Optional Extra).

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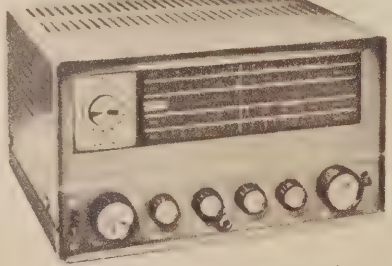
HA-350 X'TAL CONTROLLED 10-80 M. AMATEUR RECEIVER

- An Advanced Receiver of Exceptional Performance.
- Mechanical Filter.
- 12 Tubes Dual Conversion with 100KC Crystal Calibrator and Dual X'tal BFO.
- Product Detector — Selectable Upper and Lower Sideband Reception.
- Complete coverage 80, 40, 20, 15, and 10 Metre Bands. WWV on 15MC.
- Complete with All Crystals (except 100KC Calibrator X'tal Optional).

HA-350 .. £149/10/-, $299.00



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A Handsome Feature Packed Receiver for the Shortwave Listener.

- 4 Bands 550KC to 30MC (Includes Broadcast Band).
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- RF Stage for High Sensitivity.
- Electrical Bandspread on Amateur Bands 80 to 10 Metres.
- Front Panel AVC-MVC Selector. ANL and BFO.
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Atomic Absorption Spectroscopy

(Continued from page 11)

flames for atomising elements whic
form very refractory (or tightly bound
oxides which resist decomposition int
atoms. Aluminium is one case of this. D
John Willis and Mr M. Amos of th
Sulphide Corporation, independently an
almost simultaneously developed acety
lene-nitrous oxide flames which decom
pose these oxides admirably.

Another is the cheap, but high-quality
diffraction grating monochromator, no
produced commercially in Melbourne
C.S.I.R.O. designs for use with atomi
absorption experiments (or any gener
spectroscopic work as far as that goe
and selling like hot cakes in Australi
the U.K. and the U.S.A. There is n
doubt that the quality of the Australia
commercial hollow-cathode lamp
monochromators and complete atomi
absorption apparatus commands a gre
deal of respect overseas.

In setting out this fascinating story o
the growth of atomic absorption I hav
as anyone conversant with specroscop
will have noticed, had to leave out
number of "ifs" and "buts," but th
basic principles are unchanged. Also
would have been fascinating to describ
some of the somersaults performed b
the early sceptics, but shortage of spac
will save their faces!

It is difficult to say exactly where an
how atomic absorption will be used nex
It is easy to see, however, that it
already a proven success. About 13 firm
manufacture apparatus (the number
rising rapidly) under licence to th
C.S.I.R.O., and nowadays substantial ex
port income and royalties are bein
earned for Australia.

It is good for us island-bound Austra
lians occasionally to hear the kind o
remark made at a spectroscopic confe
ence in Canberra several years ago i
connection with atomic absorption...
"It is a pity about Europe and Americ
—they are so isolated."

EDITOR'S NOTE . . .

Absorption spectroscopy has opene
new fields of medical research by allo
ing accurate measurement of trace el
ments in animal and human tissue, a
cording to an article in the April "Rea
er's Digest."

It has been known for some time th
trace elements in the body have a pr
found effect on health, some elemen
being beneficial, others harmful. (Lea
poisoning, for example). Until these tra
elements could be measured accuratel
research in this direction was hindere

Scientists in U.S.A., checking po
mortem samples from many countri
have made several discoveries with t
aid of absorption spectroscopy. One
an apparent relationship between ca
mium in the body and heart and arte
diseases; another that a shortage
chromium may be related to diabetes.

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HIGH QUALITY SPEAKER
MASS PRODUCTION PRICE

AMATEUR BAND NEWS AND NOTES

Q.S.L. bureaus provide useful service

A system requiring a considerable amount of work for the convenience of amateur operators throughout the world is the exchange of acknowledgment cards through QSL bureaus, of which there is a large number.

By Pierce Healy, VK2APQ*

The volume of work and the service iven by these voluntarily organised and perated bureaus is not always appreciated y those who make use of them. The nnual Report on the activities of the ew South Wales Division's QSL Bureau imulated enough interest to warrant iking a closer look at this world-wide rvice. A discussion with Sid Molen, K2SG, the Division's QSL officer, brought rth some interesting facts.

The "Q" code abbreviation that seems to e used more than any other is "QSL" hich in effect means "Can you acknowdge receipt?" or "I am acknowledging ceipt." Although primarily for use in legraphy, the use is just as prevalent in lephony.

The abbreviation is widely used in combiations, e.g., QSL cards, QSL'ing, QSL idex or QSL bureau. The last mentioned the sorting house for the handling of SL cards on behalf of members of iany amateur radio organisations throughut the world.

Every major amateur society operates its wn QSL bureau. With the radio clubs nd QSL managers for private and comiercially organised DX-peditions included, ie total number of bureaus in Australia ins into several hundreds.

It has been said that the bureau of the adio Society of Great Britain probably as the greatest facility for ensuring that irds to remote and unusual locations re delivered.

The origin of the QSL card probably oes back to the early days of radio ommunication experiments, when the ports on tests and experiments were done y normal letter writing, and the realisation iat pertinent information of value to the kperimenter could be condensed to a andard format.

As the official acknowledgment of a ontact made between amateur stations, the SL card is the basis on which claims in be made for the various awards made y radio societies all over the world. In ome cases it is necessary to submit cards ceived to substantiate the claim for an ward. In other cases only a verification by ie QSL officer of the claimant's society is ecessary.

The receipt of a QSL card is the only ieans of proving that a contact has been iade, and that the station concerned was ot an illegally operated one. It also tends give a personal touch to what is otherise just a voice or a series of coded symbols. The card is generally designed by the operator, and is often a symbol of his imagination and the depth of his pocket. Many cards carry a scene or symbol relating to the operators' location or country.

Not all amateur operators are interested in QSL'ing and there is no law to enforce the practice, however, it is generally recognised that the QSL card is the best letter of introduction to amateur circles, whether at home or abroad.

A point made by all QSL officers is that cards should be kept to a standard size of 5½ inches by 3½ inches and that the notations made on them should be in accordance with International Postal Regulations.

In Australia, each division of the Wireless Institute has its own QSL bureau. In addition, the Federal Bureau in Melbourne handles the distribution of cards received in bulk from overseas, for the various divisions. In New South Wales during 1965, despite statements that the DX bands were in poor shape, a record number of 44,751 cards were handled through the bureau. This is 5,513 cards more than 1964.

The changing world political situation requires a great deal of work keeping check on new call signs and new nationalities that appear. During February, cards were despatched from the N.S.W. Bureau to 153 different bureaus in various parts of the world. It is rumoured that Ted Whiting VK2ACD, who looks after the outgoing cards, would welcome any ideas that would require him to personally deliver the cards to the many exotic destinations of the cards he now sends.

To the avid DX operator, the need for QSL cards is paramount if he is to maintain or improve his place on the various DX listings of countries worked. As the number of new areas with which radio contacts could be made have diminished. DX-peditions to uninhabited regions sponsored both by private and commercial organisations have created quite a deal of spasmodic DX activity.

In some circles there is a deal of controversy as to the relative values of QSL cards prepared and sent from countries because of short-duration DX-peditions to the areas concerned and those arising from contacts made with more or less permanent stations. However despite the criticism of the requirements set out by some of the DX-pedition, organisers, relating to the dispatch of their QSL cards to those requiring them, the cards are eagerly sought after.

The advantages to be gained from the receipt and dispatch of cards through the N.S.W. QSL Bureau are intended to be for members of the W.I.A. However certain concessions are available to non-members.

Full details may be obtained by writing to the QSL Officer, Box 1734, G.P.O., Sydney.

News and notes of Divisional and Club ctivities, submitted for inclusion in iese columns should be forwarded irect to Pierce Healy, 69 Taylor St., Bankstown, N.S.W.

WIRELESS INSTITUTE ACTIVITIES

Divisional Secretaries now have stocks of the 1965-1966 Australian Radio Amateur Call Book. In addition to the call signs of licensees in all Australian Call Areas, the book contains information concerning the operation of amateur stations in Australia, alphabetical list of world call-sign prefixes and other information useful to the amateur and Short-Wave listener. The price is 60c (6/) plus postage.

NEW SOUTH WALES

The Annual General Meeting of the New South Wales Division was held Friday evening, March 25th, at Wireless Institute Centre, 14 Atchison Street, Crow's Nest. About 100 members attended, as well as visitors from the Hunter Branch, and David Rankin, VK3QV, a member of Federal Executive.

The annual report presented by the retiring president Ivan Agar, VK2AIM gave a resume of the progress and the activities of the division's various sections. It was recorded that the membership of the division was the highest yet attained. The total of 1,277 is made up of 847 full members, 407 associates, 15 life members and 8 affiliated clubs. This is an increase of 59 on the 1965 membership.

The full report, which was published in the Divisional bulletin, covered seven foolscap pages. It placed on record the work done by ex-officio officers of council in conducting the A.O.C.P. classes and courses, the Youth Radio Scheme, library, Morse sessions and tape service, disposals store, monthly lectures and the tape recorded lecture service, QSL bureau: also the efforts of bulletin editors, constitution committee, and advisory committee: work on the Dural and Atchison Street properties: and reports from the branches, VHF and TV group and zone officers.

The report concluded with an expression of thanks for the assistance received from councillors and members generally throughout the year and expressed regret that circumstances prevented them nominating again for service on council. The meeting, after a brief discussion on the report, extended a hearty vote of appreciation for a very comprehensive report and the service given to the institute during the past year.

There were eight nominations for the seven positions on the divisional council and a total of 415 ballot papers were received by the returning officer.

Members elected to council for the ensuing year are:— Peter Campbell, VK2AXJ; Kevin Collins, VK2ANY; Hebe Grouse (Mrs), VK2AOK; Bill Lewis, VK-2YB; Morrie Marsden, VK2VV; Tom O'Donnell, VK2OD; Chas Wilkins, VK-2ALB.

At a short meeting of the newly elected council, Tom O'Donnell, VK2OD, was elected president of the New South Wales division.

During the usual monthly meeting following the annual meeting an excellent colour film dealing with the use of electricity in our time was screened. David Rankin, VK3QV, also addressed members on some aspects of the work being done by Federal executive, particularly in reference

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offers ALL these features

- Heat control—select 5, 6 or 7 volts. Just plug the iron into the voltage desired.
- Safe—Fully approved by the Electricity Authority all States. Approval No. N/502. No external terminals.
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- Sturdy sheet metal case with insulated feet and inbuilt iron stand.
- Developed specially for MICO 10 and 20 watt irons— suits any other iron of similar ratings.
- As the Jabel W3 was designed specially for Soldering Irons it is exempt from Sales Tax.

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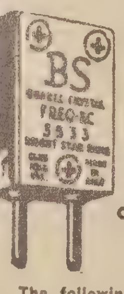

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5.5 5.5MC TV Sweep Generator Crystals.
£3/12/6 ($7.25) plus 12½ p.c. sales tax
100 KCS and 1000 KCS. Frequencies Standard.
Crystals £8/10/ ($17.00) each plus 12½ p.c. sales tax.

AUDIO ULTRASONIC AND SPECIAL CRYSTALS PRICES ON APPLICATION.

The following fishing craft frequencies are available in F.T. 243 holders: 6280, 4095, 4535, 2760, 2524, 2182, 4620, etc.
Immediate delivery available for all above types.

AMATEUR TYPE CRYSTAL 3.5 and 7 MC BAND
Commercials — from £3/12/6 ($7.25) each plus 12½ per cent sales tax.
Amateur — from £3/-/- ($6.00) each plus 12½ per cent sales tax.
Regrinds 37/6 ($3.75) each

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We would be very happy to advise and quote.

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BRISBANE

Messrs. United Radio Distributors Pty. Ltd.,
175 Phillip St., SYDNEY.

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WITH THE CO-OPERATION OF OUR OVERSEAS ASSOCIATES OUR CRYSTAL MANUFACTURING METHODS ARE THE LATEST.

to the P.M.G. "Handbook of Regulations.

On Sunday, March 6th, the second famil picnic was held in Parramatta Park Members, their wives and families mad the total present to more than fifty wh enjoyed a very pleasant day. There were n organised activities except the usual dis cussions on band conditions and interestin pieces of equipment that has been advertise or bought, or were being constructed.

WICEN

At a recent meeting of the WICEN Grou a discussion took place on the proposa by members of the Orange Radio Clu to hold a WICEN exercise in the Orang district controlled from the WICEN bas station at VK2WI Dural.

It is proposed that 146MC mobile unit will operate in the Orange area and wi be controlled via a 53MC link from Dura to Mount Canoblas, where a 53MC t 146MC repeater will retransmit to the mobil units.

The purpose of the exercise will be t test the use of VHF units in country area controlled by VHF links from Sydney. Th date of the exercise will be set after preliminary survey of the Dural-Moun Canoblas link.

Interested bodies in the area are invite to contact the Orange District Amateu Radio Club, Priestly Street, Orange, shoul they wish to observe or participate wit members in the exercise.

HUNTER BRANCH

At the Annual Meeting of the Hunter Branch held on 4th March, the election of officer for the coming year was conducted b N.S.W. Divisional President, Ivan Aga VK2AIM.

The executive elected is:—President, Fran Cox, VK2APO. Vice-Presidents, Keith Howard, VK2AKX; Bill Hall, VK2XT. Treasurer, Len Daley, VK2ZFD. Secretary Gor don Sutherland, VK2ZSG. Social Secretary Bill Munn, VK2ZWM. Zone Correspondent Keith Howard, VK2AKX. VHF Liaiso Officer, Mac O'Brien, VK2ZMO. QS Officer, Stan Lloyd, VK2AYL Asst. Zon Correspondent, Joe Waugh, Assoc.

In his report on the activities of th Branch during the past year, President Fran Cox, VK2APO, indicated that there ha been a good attendance at the monthl meetings and expressed appreciation to th trade houses who provided a number o guest speakers thoughout the year.

Special mention was made of the wor done by Keith Howard, VK2AKX, in preparing and organising the presentation o Branch news broadcasts to members. Othe aspects mentioned were the constructiona competition held in conjunction with th annual field day, the sucess of the Annua Dinner and the publicity given each Saturda in the "Newcastle Morning Herald."

Thanks were extended to Sydney an Newcastle trade houses for their support i providing trophies and literature for competitions and contests, also, to committe members and officers of the Division fo their interest in Branch affairs.

Monthly meetings of the Branch are hel in Room 6 of the Clegg Building, Newcastl Technical College, commencing at 8 p.m on the first Friday of each month. Visitor and intending members are always welcome

VHF AND TV GROUP

Preparations are in hand for holding th Mid-Winter Contest on the Queen's Birthda Holiday weekend in June. At the time o writing these notes a resume was bein made of members' suggestions of the for the contest should take. It is anticipate that the full rules will appear in nex month's issue of "Electronics Australia."

The third sub-edition of the "Amateu Guide" has been completed and is availabl for 25c (2/6). This publication contains collection of the articles that have appeare in divisional bulletins, as well as lectur notes and circuits presented at VHF Grou meetings. The price of all editions to dat is $1.75 (17/6). They can be obtained b enclosing a postal note to "Amateur Guide, Wireless Institute Centre, 14 Atchison Stree Crow's Nest.

DX-PEDITION NEWS

For the DX operator a bulletin called X-pedition of the Month," is published the Hammarlund Manufacturing Com- ny. A copy just received, in addition to ing a lengthy review of the position in lation to logs of DX-peditions from 1963 1965, gave the following details of in- est.

New QSL Address:— "DX-pedition of the onth" has a new QSL address. It is P.O. x 7388, Newark, New Jersey, 07107. is change will provide more efficient pro- ssing of the outgoing QSL Cards as a mber of other amateurs in the North rsey area will assist Stuart Meyer W2GHK.

The procedure for handling QSL's is:— l cards are mailed to the various QSL reaux throughout the world unless ac- mpanied by a self-addressed stamped en- lope, or a self-addressed envelope with C coupons. You may send more than e card in a single envelope; however, if u wish direct return, you should send one lf-addressed stamped envelope for each parate card.

Because of the large number of cards ndled, it is almost impossible to accu- ulate outgoing cards for direct return in single envelope. You may, however, send a mixed group of direct return and reau return cards in the same incoming velope, but be sure that you indicate ich is to go direct. Each direct return rd requires a separate envelope (stamped r IRC's).

Two DX stations which have provided ny good contacts have now closed down d the operators are returning to their spective homeland QTH. Sioerd Heeringa. 2AA, has returned to Holland, and Peter odd 7Q7PBD to the United Kingdom.

Future DX-peditions with the QSL cards ndled through DX-pedition of the month reau are being planned for Annobon, , 3V8 plus the rotation of equipment in VP8 area for approximately six months d a QSL service for a CO2 station operat- g on SSB.

CENTRAL COAST BRANCH

The Annual Meeting of the Central Coast anch, held at the School of Arts, Gosford, Friday evening March 18th, had a larger endance than recent monthly meetings. e main business of the evening, the elec- n of officers for the forthcoming year sulted in the following members being cted.

President, Lindsay Douglas, VK2ON.
Vice-President, Ern Hodgkins. VK2EH.
Secretary, Frank Jarvis, VK2AFJ.
Treasurer, Phil Levenspiel, VK2TX.
Pub. Officer, Mona Swinton, VK2AXS.
Public Relations, Gordon Proctor, Assoc.

The Branch meets on the third Friday of ch month, when interesting lectures and cussions relating to amateur radio are the inciple items on the agenda. Visitors are ways welcomed to these meetings and de- ls of the activities can be obtained from secretary.

S.W.L. GROUP

The Annual Meeting of the N.S.W. Short ave Listeners Group took place at the ireless Institute Centre, on Friday evening, arch 17th. The attendance was smaller n was expected but nevertheless the eting was quite successful.

The Federal Councillor, Pierce Healy, 2APQ was invited to be chairman for meeting. After a discussion on matters ating to the function of various officers d aspects in the running of a S.W.L. up, nominations were called for the posi- ns on the committee.

Those elected were: —

President, Gordon Croutch.
Vice-President and Liaison Officer, Ross win.
Secretary-Treasurer, Chris Middleton- illiams.
Publicity and Q.S.L. Officer, Chas Aber- athy.

The group meets on the third Friday of h month at W.I.C., Crows Nest. Intend- members and visitors are welcome.

VICTORIAN DIVISION

The Victorian Divisions' WICEN organisation was called upon on Wednesday, March 9th, when a large bush fire burning between Yea and Glenburn threatened telephone lines carrying vital fire and relief traffic.

The P.M.G. Divisional Engineer in the area contacted Bruce Wilson, VK3IG, the WICEN Zone co-ordinator for the area, with a request for radio back-up by a WICEN group. This request was acceded to and four mobile units were made available. The State WICEN co-ordinator was advised of the decision and a radio link was established to VK3AWI and VK3IZ on 3550KC. However at 7.30 p.m. the direction of the wind changed and the fire moved away from the threatened telephone lines so further assistance by WICEN was not needed and the alert ended at 9.00 p.m.

On Saturday, March 12th, Peter Linden VK3BX reported that a fire which appeared to have been deliberately lit was burning close to the Mountain Highway near Sassafras in the Dandenong Ranges. Peter called John Beckett VK3CB, at Olinda, on the 144MC FM net frequency who passed the details to the fire control office, and several fire brigades were despatched to the area. Although the fire had been started in several places it was brought under control before any property was threatened.

The Upwey radio group have expressed their thanks to Peter for promptly reporting the fire and his subsequent work in assisting the various fire brigades by transporting firemen and equipment in his car.

ZONE CONVENTION

The annual convention of the South West Zone was held during the weekend March 12th and 13th, at Warrnambool. There was a good attendance, which included visitors from South Australia. President of the Victorian division Ken Pincott, VK3AFJ, presided over the annual meeting for the election and installation of officers for the forthcoming year.

The officers elected were:— President, Eric Giddings, VK3ANQ; senior vice-president, W. J. Bell, VK3WK; junior vice-president, Bill Dennis, VK3XE; secretary - treasurer, Bill Wines, VK3AAW, representative; auditor, Peter Furr, VK3FX; station officer, Harry Duggan. VK3AXI; WICEN co-ordinator, John Woodburn, VK3AGD.

Committee Members:— Chris Hall, VK-3AWQ, Representative; Gordon Vincent, VK3AGV; Bob Wookey, VK3IC; David Stacpoole, VK3ZTN; Ron Heighway, VK-3ABK.

After the meeting a barbecue tea was held, followed by a screening of films by Chris Hall, including the Snowy Mountains Scheme and surf championships held at Warrnambool. There was also an auction sale of equipment supplied by VK3LC and VK3WK, Peter Furr, VK3FX, acted as auctioneer.

On Sunday morning the judging of the best mobile installation took place, resulting in the following winners:— Commercial VHF, Peter Furr, VK3FX; Home Built, David Stacpoole, VK3ZTN. The 144MC blindfold hidden transmitter hunt was won by Terry Gordon.

All Band Scramble: H.F. Section, Alf Chandler, VK3LC; V.H.F. Section, David Stacpoole, VK3ZTN.

Following a picnic lunch a 80-metre transmitter hunt was conducted and resulted in Jack Taylor, VK3ZJF, locating the transmitter with only minutes to spare, hidden in a steeplechase jump in the racecourse. Jack went on to complete a double by winning the 144MC Hidden Transmitter Hunt. Presentation of prizes to the successful competitors concluded the activities of a very successful convention.

Members of the South West Zone extend their thanks to Mr Conroy, principal of the Warrnambool Technical College, for the use of the college canteen and assembly hall for the meetings.

A hookup of South West Zone members

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10% preferred range in 5% tolerance.
½ watt, ¼ watt, ⅛ watt, 1/32 watt.
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100 volt Tol. plus or minus 10%.
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MINIATURE ELECTROLYTICS
IDEAL FOR MODERN CIRCUIT BOARD MOUNTING.
3, 6 or 10 V.W.
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"SUNRICH" PORTABLE 5 TRANSISTOR TAPE RECORDER

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Reduced from £22/10/
Complete with Tape Battery
Phone and Mike

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CHROME VAN

German screwdriver and pocket tester.

1. 6-12 volt model auto tester.
2. Sparkplug tester.
3. 110-380 Volt mains tester.

$1.25 each

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Model RH-50

Modern Design, 33 Micro Amp Meter.

30,000 Ohms per Volt D.C.

13,000 Ohms per Volt A.C.

1 p.c. Multipliers and Shunts used. Printed circuit.

Clear Scale, rugged moulded case.

SPECIFICATIONS

DC Voltages: 0-0.3-1.2-3-12-30-120-300-600-1,200 V at 30,000 Ohms per volt.

AC Voltages: 0-3-12-30-120-300-600-1,200 V at 13,000 Ohms per volt.

DC Current: 0-.06-6-60-600 mA, 0-12 A.

Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).

Decibels: minus 20 to plus 57 dB (0 dB equals 1 mW. 600 ohms).

Audio Out: Capacitor in series with AC volt ranges.

Short Test: Internal buzzer.

Accessory: 1 pr. heavy test leads.

Price $31 (£15/10/

Postage 50c to $1 extra.

Batteries: 1 (1.5V), 1 (15V).
Size: 3 5-16" x 6 5-16" x 2
Weight: 1.4lb approx.

LIMITED STOCK ONLY

Model RH-10

RANGES:

DC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.

AC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.

DC Current: 0-500uA 0-500 mA.

Resistance: 0-10K-1 Meg: 60 ohms, 6 Kohms at centre scale.

Capacitance: 250uuF to 1uF, in two ranges.

Decibels:—20 to plus 36db, two ranges.

Output: 0-1,000 V in four ranges.

Size: 5in x 3½in x 1½in.

Weight: 13oz approx.

Price $10.75 (£5/7/6)

Postage 50c to $1 extra.

Model RH-5

- High sensitivity-20,000 Ohms/V DC, 10,000 Ohms/V AC.
- 3in Meter.
- Handy pocketable size.

SPECIFICATIONS

DC Voltages: 0-10-50-250-500-1000 V (20,000 Ohms/V).

AC Voltages: 0-10-50-250-500-1000 V (10,000 Ohms/V).

DC Current: 0-50uA, 0-5-50-500mA.

Resistance: 0-10K, 0-100K, 0-1Meg, 0-10Meg.
(62 Ohms, 620 Ohms, 6.2K, 62K at centre scale).

Capacitance: 0.0001uF-0.005uF, 0.05uF-1uF.

Decibels: minus 20db to plus 36db in 2 ranges.

Dimensions: (3½" x 5½" x 1¾").

Weight: 15oz approx.

Complete with internal battery, testing leads with prods.

Price $18 (£9/0/0)

Postage 50c to $1 extra.

PORTABLE TRANSISTOR TAPE RECORDER

"SUNACE" PD 401

$21.00 (£10/10/-)

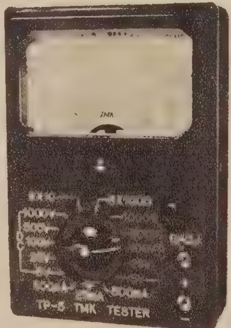
Postage 75c (7/6)

Complete with Mike, Battery and Tape.

MODEL TP-5 POCKET VOM. TESTER

RANGES:

- DC Voltage: 2,000 OHMS per VOLT 0-5-25-100-250-1000 Volts.
- AC Voltage: 2,000 OHMS per VOLT 0-5-25-100-250-1000 Volts.
- DC Current: 0-500uA, 25uA, 500mA.
- Resistance: 0-20K, 0-2Mg. OHMS.
- Capacitance: 500uuF to 0.1uF at 100V AC. 0.01uF to 2uF at 5V AC.
- Decibels: minus 20 DB to plus 48DB In 5 ranges.



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PHONE 26-2817

kes place each Sunday morning at 10 m., on 80 metres. Details of all zone ctivities can be obtained from:— Bill ines, hon. secretary, c/ Warrnambool and istrict Y.M.C.A. Youth Radio Club, cnr. ava and Henna Streets, Warrnambool.

V.H.F. GROUP

The annual general meeting of the Vicrian Division VHF Group was held on ednesday evening, March 16th, at the stitute Rooms, 478 Victoria Parade, East elbourne. More than fifty members and isitors were present for the election of fficers for the current year. The results f the election were as follows:— Chairan. Cyril Edmonds, VK3AEE; vicehairman, Jack Taylor, VK3ZJF; secretary, eter Wolfenden, VK3ZPA; treasurer, revor Thompson, VK3ZTJ; publicity offier, Cyril Maude, VK3ZCK; equipment fficer, Ken Jewell, VK3ZNJ; QSL manager, ill Rice, VK3APB.

QRP

From time to time news comes to hand of w power experiments by enterprising amaurs. The most recent piece of news on ctivities in this field is of a 144MC contact ade over a distance of 15 miles.

Using a prototype transistorised transitter of their own design, with an input of 5 mW, in conjunction with a 10-element agi aerial, Barry Wootten, VK3AK and artin, VK3ZMN worked Peter, VK3ZEP. mplitude modulation was used and the gnal report was readability 4, strength 5.

FREQUENCY CHECKS

Victorian amateurs are advised that a freuency check of their mobile equipment can e made at a branch of the P.M.G. Deartment at 425 St. Kilda Road, Melbourne. his service has been available for some ime but most amateurs are not aware of the act that such checks can be made in the ity. This service is mainly used for checks f mobile equipment used by taxis, police nd commercial services.

An amateur wishing to use this service ust drive his vehicle to the rear of the uilding, then apply to the officer-in-charge or his frequency check, giving his call sign nd a list of the frequencies he wishes to ave checked. This service is given by the .M.G. Department to both commercial and mateur services.

QUEENSLAND

As only 11 nominations were received for he twelve positions on the Divisional ouncil, no ballot was necessary to decide ho would constitute the 1966 Council.

The nominations received were:—
L. Blagbrough, VK4ZGL .
F. R. Campbell, VK4ZRC.
A. E. Carter, VK4LT.
G. G. Down, VK4XY.
C. J. Files, VK4JF.
V. P. S. Green, VK4VS.
R. W. Holland, VK4AQ.
T. A. Lane, VK4ZAL.
L. L. Sharp, VK4NS .
R. M. Vickary, VK4VX.
D. R. Watson, VK4DZ.

The office bearers for the ensuing year ill be determined at the first meeting of the ew Council, after the Annual General eeting.

WESTERN AUSTRALIA

A slow Morse practice session is broadast on behalf of the West Australian Diviion by Bob Elms, VK6BE, each Wednesday vening at 7pm local time. These broadcasts re made on the 80-metre band and on 44MC, FM, channel 'B'. Reports on recepion of these broadcasts will be appreciated.

SOUTH AUSTRALIA

The nominations for election to the ouncil of the South Australian Division ere:—
John Allen, VK5UL.
Murray Burford, VK5ZQ.
Ross Dow, VK5KF.
Tom Laidler, VK5TL.
Al Rechner, VK5EK.
Harry Roberts, VK5MY.
Ron Sedunary, VK5KS.

As there were only seven nominations, there will not be a ballot and those named will serve for the next 12 months. In addition, Phil Williams, VK5NN, and Geoff Taylor, VK5TY, will, by virtue of the office they hold, continue to serve on the council.

WICEN co-ordinator Geoff Taylor, VK5TY, reports that good progress is being made, and message-handling practices are being recorded, to enable post mortems to be made with the object of improving the operation of the net. A total of 45 stations is now actively operating on 53.1MC.

ELIZABETH AMATEUR RADIO CLUB

At the May monthly meeting of the Elizabeth Amateur Radio Club, to be held at their usual meeting place, Primary School, Chivel Street, Elizabeth South, commencing at 8pm, a lecture will be given on "Unidentified Flying Objects." The club extends a cordial welcome to non-members to attend at this interesting lecture.

The Club sponsors the "Elizabethan Award" which will be made to any amateur or short-wave listener who makes contact with members of the Club, under the following conditions:

1. Overseas amateurs are required to make six contacts with E.A.R.C. members.
2. Australian amateurs require eight contacts with E.A.R.C. members.
3. Any V.H.F. (50MC and above) QSO counts as two contacts.
4. Any QSO with the E.A.R.C. station VK5LZ counts as two contacts.
5. Short Wave Listeners may apply but must also include the call sign of the station being worked by the E.A.R.C. club member.

Another award made by the Club to S.W.L.'s is the "G" award. This award is open to any S.W.L. in Australia who submits proof in the form of 12 QSL cards from United Kingdom amateur stations. All cards must be in relation to 20-metre phone contacts and must include prefixes GI, GM or GW. Other cards can be from any "G" station and GB cards may be included.

Details of the activities of this progressive club can be obtained bv writing to E. Luff, 5 Shaftesbury Road, Elizabeth Vale, South Australia.

TASMANIA

In a recent edition of the monthly Bulletin of the Tasmanian Division, Editor Ted Beard, VK7EB, published details of an "electronic fish caller," with a Hartley oscillator, using a single 2N1265 transistor. Ted recommends the unit for use when operating mobile marine. The only request made of those making use of the idea is "not to forget him when you haul them in."

It is common knowledge that fish are attracted by certain man-made noises. It seems that they believe the sounds to be coming from some source of food and the technique has been used successfully by fishermen. No doubt some agreement can be made with Ted to supply further details of the unit.

144MC MOONBOUNCE

Amateurs on both sides of the Pacific Ocean are on the verge of setting new records for two-way communication on 144MC. In fact signals have been copied each way, demonstrating that two-way contacts are a definite possibility. Tests are being conducted by Ray Naughton, VK3ATN, located in Birchip in north-western Victoria and operators at Stanford University in California, using the call sign K6MYC.

On the 1st and 5th March, signals from VK3ATN were copied quite well at Stanford University, on March 1st signals from Stanford were copied rather poorly but on March 5th at 0845 to 0900 G.M.T. were heard quite well at Birchip.

Stanford University runs a power input of 1KW to a 60ft dish antenna. Ray, VK3ATN, used 150W input to a 4X150A, into a 50 wavelength per leg stacked rhombic antenna aimed at 5 degrees above the eastern horizon, and approximately 60 degrees true azimuth. The moon is within 2 degrees of this point in space approximately 20 minutes on each of five consecutive days, every 29 days.

In addition to giving these details Ray wrote: "During a two hour 7MC sked after the test on March 5th, we discussed at great length the methods by which the gain at each end could be increased and have decided to add a transistor pre-amp, also stack four instead of two single-wire rhombics of the same length, but a little higher to lower the angle of radiation by one degree, alter main lobe alignment and alter shape of rhombic slightly. All this should net approximately 6dB gain at this end. The Stanford group are going to alter their

CRYSTAL DIVISION

Manufacturers of Quartz Crystals for Frequency Control and Crystal Filters for Highly Selective Circuits, Announce:—

NEW LOWER PRICES FOR CLOSE TOLERANCE GOLD PLATED CRYSTALS FOR AMATEUR APPLICATIONS

- 1.8 Mc/s to 14.999 Mc/s ± 0.005% in Style "D" holders, ½in pin spacing. **Amateur net £2/8/6 each including tax.**
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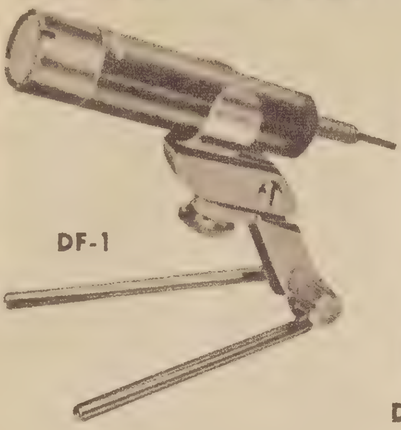
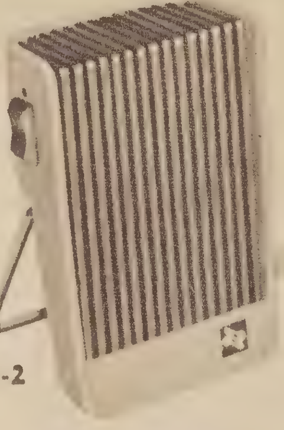


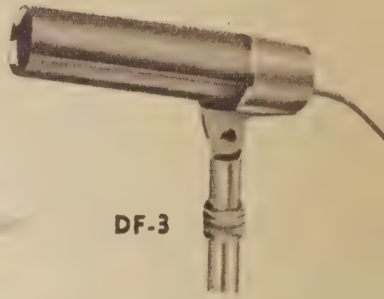
DF-1

50K ohms £5-12-0
50 ohms £4-18-6
Price Retail Plus Tax
Frequency Range
100-12,000 C/S.



DF-2

50K ohms £2-14-0
50 ohms £2-5-7
Price Retail Plus Tax
Frequency Range
200-10,000C/S.



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50K ohm £4-16-0
50 ohm £3-18-4
Price Retail Plus Tax
Frequency Range
50-15,000 C, S.

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3/5W	**$42**
12/15W	**$62.62**
30/40	**$77.50**
60/70	**$98.30**
100/120	**$113.30**
250/300	On application

Complete with Hi Imp input and tone control Pick-up input and tone control, 100 V line out. Tax 12½% unless to be used for Music purposes then 25% 50 ohm input with Mu Metal transformer mounted on chassis—$15.25 additional.

Transistor amplifiers.
A.S.T.—5/12 W, **$28** to **$42** plus 12½% sales tax.
A.S.T. 30/40 W Guitar amplifiers, **$180** plus 25% sales tax.
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Tax 12½%.
A.S.T. Radio tuners from **$10.**

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- Transistorised
- Will efficiently cover 500 people.
- Works off Torch Batteries
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- The most advanced self-contained P.A. System available

Can be supplied with Neck Microphone, Cardoid Microphone Telescopic Stand.

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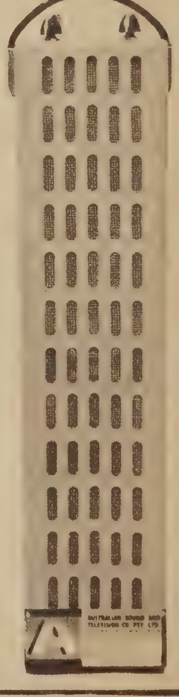

sh feed and also try diversity reception.

"We hope to make two-way contact both ı 144MC and 432MC before the end of '66."

VALE

It is with much regret and deepest sym-ıthy to their families that we record the ıaths of three members of the New South 'ales Division .

Dr Frank Adcock, a Life Member.

Hector Harvey, VK2ACI, who was at one ne Treasurer of the N.S.W. Division.

Frank Pearson, VK2ACQ, well known r his work in organising the Division's 'orse code practice sessions and tape ser-ıce. Frank was at the time of his death ountry Liaison officer of the N.S.W. Div. ouncil.

The work done by these for the W.I.A. ıd amateur radio will be remembered by ıeir many friends.

International Telecommunication Union

The second and main session of the eronautical Radio Conference convened ' the International Telecommunication nion (I.T.U.) commenced an eight-week ssion on March 14th, at the Maison des ongress in Geneva. The first session of e Conference met in Geneva for four eeks in January and February, 1964.

At the opening meeting some 120 dele-ıtes from more than 40 I.T.U. Member ountries were present. The Confer-ıce elected as Chairman Dr Arthur L. ebel, Head of the United States Delega-on, who was Chairman of the Last Aero-ıutical Conference and the first session of e present one. As Vice-Chairmen it chose r Alexandre Jarov, Head of the U.S.S.R. elegation and Mr R. Monnat, who is the Swiss Delegation.

The main purpose of the Conference is to 'aw up a new world-wide plan for high-equency long-range communications for rcraft flying on national and international vil air routes. The existing radio frequency locations for this purpose are contained in Frequency Allocation Plan drawn up by e last I.T.U.'s Aeronautical Radio Con-rence, held in Geneva in 1948 and 1949.

These plans govern radio communications etween aircraft and the ground and are us essential to air traffic control for the 'oidance of collisions. Although the exist-g plan has generally worked well over the ears, a new plan has been necessitated by e changes in the activity and pattern of vil aviation since 1949, i.e., the great in-ease in air traffic, changes of flight routes ıd the opening of new ones in areas such the North Pole, the Indian Ocean and ırts of the Soviet Union.

Other new factors will have to be con-dered by the Conference, such as the de-lopment of V.H.F. communications which ill reduce the use of high frequencies for ort-range communication in many parts the world, the problems for communica-ons which will arise with the introduction supersonic aircraft, and the question of e establishment of more centres for broad-sting meteorological information to air-aft. It has also been suggested that the onference should make preliminary ex-nination of the possible use of space mmunications for aeronautical purposes.

The operational and technical principles be used in the preparation of the new an were determined at the first session of e Conference in 1964. In the intervening riod since then, the telecommunication lministrations of the member countries ıve been submitting statistics of flight tivity to the Union for analysis.

In a statement to the Conference, the cretary-General of the I.T.U., Dr M. B. ırwate, said it was most encouraging to ote "the recent experiments carried out 'er the North Atlantic and the Pacific, ing communication satellites of the syn-ronous type for aeronautical communica-on. These developments are bound to lead further trials and thus open up a new a in the progress of aeronautical communi-tion."

W.I.A. YOUTH RADIO SCHEME

The Federal Co-ordinator of the Youth Radio Scheme has been advised by the Overseas Telecommunications Commission that 20 per cent of the intake of trainees for 1966 were Youth Radio Club members. Other students have won cadetships in various commercial and Government organisations.

More than thirty members and former members of Youth Radio Clubs in New South Wales have now gained amateur operator's certificates. They are:—

Ian Forrest (Booragul High School), VK2AJF.

George Brzostowski (Lyneham High School), VK1GB.

Roger Davis (Lyneham High School), VK1RD.

Andrew Davis (Lyneham High School), VK1DA.

Paul Goldsbrough (St. Edwards College), VK2AVX.

David Davies (Canberra Grammar School), VK1DD.

Garry Tippett (St. Edwards College), VK2UX.

Vincent O'Donnell (St. Leo's College), VK2ZOD.

Harvey Smith (St. Leo's College), VK2ZYZ.

Susan Brown (Booragul High School), VK2BSB.

Jan Oosterveen (Booragul High School), VK2BJO.

Jim Watson (Lyneham High School), VK1JW.

Ralph Satchell (Club Leader Homebush High), VK2ZRS.

Joe Mack (Kings School), VK2ZJM.

Phillip Lowe (Epping High School), VK2ZLL.

Roger Adams (Canterbury High School), VK2ZTE.

Patrick Maloney (Westlakes Radio Club), VK2AUX.

Fred Overvliet (Westlakes Radio Club), VK2ZFO.

Henry Schroeder (Westlakes Radio Club), VK2ZGK.

Michael Latham (Westlakes Radio Club), VK2ZLB.

David Russell (Westlakes Radio Club), VK2BSC.

Robert Blyth (Westlakes Radio Club), VK2BOB.

Colin Christiansen (Westlakes Radio Club), VK2BCC.

Dick Smith (Sydney Teachers College Radio Club), VK2ZTV.

Other successful candidates are:—

Doug Williamson (Club Leader, Bass Hill High School).

Wal Bray (Club Leader, Canterbury High School).

John Thyrd (Kingsgrove North High School).

Terry Crews (Gosford High School).

Ernest Chalker (Postal Group No. 1).

Bruce North (Kiama High School).

Two new clubs that have registered with the scheme are:—Steadfast Radio Club (Bankstown Baptist Boys Brigade), Club Leader Tom Ivins, VK2SS. The club station call sign is VK2BBB. Kiama High School Radio Club is now on the air under their Call Sign VK2AXG.

Mr Ken Matchett VK3TL, has had to retire from the position as Victorian Supervisor of the Y.R.S. Ken piloted the scheme through the first three years of its inauguration in Victoria, during which it has grown from five to the present total of 30 members clubs. Until a new Supervisor is appointed, Mr E. D. Buck, 263 Gooch Street, Thornbury, Vic., is handling all Y.R.S. correspondence.

At the end of March, clubs registered in Victoria were: —

Scotch College Radio Club;

Geelong Grammar School Radio Club;

A.P.I. Radio Club;

Gowrie Park Radio Club;

Christian Brothers Edmond Rice College Radio Club;

Essendon Grammar School Radio Club;

Caulfield Grammar School Radio Club;

Australian Air League Squadron;

Kurrumburra High School Youth Radio Club;

Hamilton and Alexandra Colleges.

The City of Oakleigh Youth Club, Horton Road, Oakleigh, Victoria, have a lecture and practise room for use by a radio group, but require a Club Leader. Anyone interested in filling the position is invited to contact the club at the above address, or ring E. D. Buck (Melbourne phone) 202411.

Two clubs in Perth making good progress are Wesley College under the leadership of Laurie Jessop, VK6ZEA, and the Christian Brothers College at Leederville, under Jack Morgan, VK6RT. The Wesley College Club provides a two-hour training session for its 21 members during an "Activities Period" recently introduced into the schools' timetable, each Wednesday afternoon.

Mullard Australia Pty. Ltd. have generously donated ten copies of their "Valve, Tube, and Semiconductor Guide" valued at one dollar fifty cents per copy, for distribution among the groups in the Queensland Division's Youth Radio Scheme. A ballot will be held to decide which clubs will receive a copy of this useful publication.

CHRISTMAS ISLAND

The AT13B transmitter purchased by Club members of the Christmas Island Radio Club, through the Queensland Division of the W.I.A. is being installed at the apprentice room of the club and will be used for instructional purposes as well as the AM/CW VK9XI Club transmitter. Several members of the club will be sitting for the A.O.C.P. examination in May, after which it is anticipated there will be some new call signs on the Island. The Club also provides an instruction class by a qualified Chinese-speaking instructor. ■

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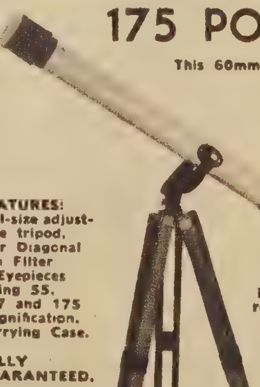

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W.I.A. LIST OF COUNTRIES

The official list of countries for Australian DX Awards given by the Wireless Institute of Australia is published once each year in the Institute's magazine, "Amateur Radio." This listing is very similar to that published by the American Radio Relay League and shows the additions and deletions made since publication of the previous list. The following list, published in the January 1966 issue of "Amateur Radio," is reproduced with the permission of the editor.

Call Area	Country
AC3	Sikkim
AC4	Tibet
AC5	Bhutan
AP	East Pakistan
AP	West Pakistan
BV (C3)	Formosa
BY(C)	China
C9 (prior to 1/1/64	Manchuria
CE	Chile
CE9, KC4, LU-Z VK0 VP8, ZL5 etc.	Antarctica
CE0A	Easter Island
CE0X	St. Felix Island
CE0Z	J. Fernandez Arch.
CM, CO	Cuba
CN2 (prior to 1/7/60)	Tangier
CN2, 8, 9	Morocca
CP	Bolivia
CR3	Portuguese Guinea
CR4	Cape Verde Islands
CR5	Principe, Sao Thome
CR6	Angola
CR7	Mozambique
CR8 (prior to 1/1/62)	Goa
CR8, 10	Portuguese Timor
CR9	Macao
CT1	Portugal
CT2	Azores
CT3	Madeira Island
CX	Uruguay
DJ, DL, DM	Germany
DU	Philippine Islands
EA	Spain
EA6	Balearic Islands
EA8	Canary Islands
EA9	Ifni
EA9	Rio de Oro
EA9	Spanish Morocco
EA0	Spanish Guinea
E1	Republic of Ireland
EL	Liberia
EP, EQ	Iran
ET2 (prior to 14/11/62)	Eritrea
ET2, 3, 9E	Ethiopia
F	France
FB8	A'dam and St. Paul Is.
FB8	Crozet Island
FB8	Kerguelen Island
*FF8	French West Africa
TU2 (from 7/8/60)	Ivory Coast Republic
TY2 (from 1/8/60)	Dahomey Republic
TZ2 (from 20/6/60)	Mali Republic
XT2 (from 5/8/60)	Voltaic Republic
5U7 (from 3/8/60)	Niger Republic
5T5 (from 20/6/60)	Mauritania
6W8 (from 20/6/60)	Senegal Republic
FG7	Guadeloupe
FH8	Comoro Islands
F18 (prior to 20/7/55)	French Indo China
FK8	New Caledonia
FL8	French Somaliland
FM7	Martinique
FN (prior to 1/11/54)	French India
FO8	Clipperton Island
FO8	French Oceania
FP8	St. Pierre and Miquelon Islands
*FQ8	French Equatorial Africa
TL8 (from 13/8/60)	Central Africa Republic
TN8 (from 15/8/60)	Congo Republic
TR8 (from 17/8/60)	Gabon Republic
TT8 (from 11/8/60)	Chad Republic
FR7 (from 25/6/60)	Glorioso Island
FR7 (from 25/6/60)	Juan de Nova and Europa Island
FR7	Reunion Island
FR7	Tromelin Islands
FS7	Saint Martin
FU8, YJ1, 8	New Hebrides
FW8	Wallis and Futuna Island
FY7	French Guiana and Inini
G	England
GC	Guernsey Islands and Dep.
GC	Jersey Island
GD	Isle of Man
GI	Northern Ireland
GM	Scotland
GW	Wales
HA	Hungary
HB	Switzerland
HC	Ecuador
HC8E	Ebon Atoll
HC8G	Galapagos Islands
HB0 (HE)	Liechtenstein
HH	Haiti
HI	Dominican Republic
HK, 5 J	Colombia
HK0	Arch. of San Andres and Providencia
HK0	Malpelo Islands
HL, HM, 6N5	Korea
HP	Panama
HR	Honduras
HS	Thailand
HV	Vatican
HZ (see 7Z)	
I1 . IT1	Italy
IL (prior to 1/4/57)	Trieste
IS (prior to 1/7/60)	Italian Somaliland
ISI	Sardinia
JA, KA	Japan
JTI	Mongolia
JY	Jordan
JZ0(prior to 1/5/63)	West New Guinea
K, W	United States America
KA0, KG6I	Bonin and Volcano Islands
KB6	Baker, Howland and American Phoenix Islands (including Canton Island)
KC4	Navassa Island
KC6	Eastern Caroline Islands
KC6	Western Caroline Islands
KG4	Guantanamo Bay
KG6	Guam
KG6	Marcus Island
KG6 (Rota, Tinian, Saipan, etc.)	Mariana Islands
KH 6	Hawaiian Islands
KH6	Kure Island
KJ6	Johnston Island
KL7	Alaska
KM6	Midway Islands
KP4	Puerto Rico
KP6	Palmyra Group, Jarvis Island
KR6	Ryukyu Island
KS4B	Serrana Bank and Roncador Cay
KS4	Swan Islands
KS6	American Samoa
KV4	Virgin Island
KW6	Wake Island
KX6	Marshall Islands
KZ5	Canal Zone
LA	Bouvet Island
LA	Jan Mayen
LA	Norway
LA	Svalbard
LU	Argentina
LZ	Bulgaria
MP4	Bahrein
MP4	Qatar
MP4	Trucial Oman
OA	Peru
OD5	Lebanon
OE	Austria
OH	Finland
OH0	Aland Islands
OK	Czechoslovakia
ON4	Belgium
OX, KG1	Greenland
OY	Faeroes
OZ	Denmark
PA0, PI1	Netherlands
PJ	Netherlands West Inc
PJ2M	Sint Maarten Islands
PK1, 2, 3 (prior to 1/5/63)	Java
PK4 (prior to 1/5/63)	Sumatra
PK5 (prior to 1/5/63)	Borneo
PK6 (prior to 1/5/63)	Celebes and Molucca lands
PX	Andorra
PY	Brazil
PY0	Fernando de Noronh
PY0	St. Peter and Paul R
PY0	Trindade and Ma Vaz Island
PZ1	Netherlands Guiana
SL, SM	Sweden
SP	Poland
ST2	Sudan
SU	Egypt
SV	Crete
SV	Dodecanese
SV	Greece
TA	Turkey
TF	Iceland
TG	Guatemala
TI	Costa Rica
TI9	Cocos Island
TI9C	Cormoran Reef
TJ (FE8)	Cameroon Republic
TL, TN ,TR, TT	(See after FF8)
TS (3V8)	Tunisia
TU, TY, TZ	(See after FF8)
UA1 - 6, UN1	European R.S.F.S.R.
UA1	Franz Josef Land
UA2	Kaliningrad Region
UA9, 0,	Asiatic R.S.F.S.R.
UB5	Ukraine
UC2	White Russian S.S.R.
UD6	Azerbaijan
UF6	Georgia
UG6	Armenia
UH8	Turkoman
UI8	Uzbek
UJ8	Tadzhik
UL7	Kazakh
UM8	Kirghiz
UN1 (prior to 1/7/60)	Kar - Fin. Republic
UO5	Moldavia
UP2	Lithuania
UQ2	Latvia
UR2	Estonia
VE, VO,	Canada
VK	Australia
VK2	Lord Howe Island
VK4	Willis Island
VK9	Christmas Island
VK9	Cocos Island
VK9	Nauru Island
VK9	Norfolk Island
VK9	Papua Territory
VK9	Territory of New Gu
VKO	Heard Island
VKO	Macquarie Island
VO (prior to 1-4-49)	Newfoundland, Labra

OR DX AWARDS

1	British Honduras
2 (prior to -6-58)	Leeward Islands
2	Anguilla
2	Antigua Barbuda
2	Montserrat
2	St. Kitts, Nevis
2 (prior to -6-58)	Windward Islands
2	Dominica
2	Grenada and Dependencies
2	St. Lucia
2	St. Vincent and Dependencies
3	British Guiana
4	Trinidad and Tobago
5	Cayman Islands
	Turks and Caicos Is.
6	Barbados
7	Bahama Islands
8	Falkland Islands
8, LU-Z	South Georgia
8, LU-Z	South Orkney Islands
8, LU-Z	South Sandwich Islands
8, LU-Z, CE9	South Shetland Islands
9	Bermuda Islands
6 (prior to -7-60)	British Somaliland
8	Agalega and St. Brandon
8	Chagos Islands
8	Mauritius
8	Rodriquez Islands
9	Aldabra Islands
9	Seychelles
1 (including Canton Island)	British Phoenix Islands
1	Gilbert and Ellice Islands, Ocean Islands
2	Fiji
3	Fanning and Christmas Islands
4	Solomon Islands
5	Tonga Islands
6	Pitcairn Island
4 (prior to 6-9-63)	Sarawak
5	Brunei
6	Hong Kong
9	Aden and Socotra
9	Kamaran Islands
9	Kuria Muria
9	Maldive Islands
	Sultanate of Oman
2	India
	Laccadive Islands
	Andaman and Nicobar Islands
, XF	Mexico
4	Revilla Gigedo
2	(See after FF8)
	Cambodia
/8	Laos
2	Burma
	Afghanistan
	Iraq
	Syria
, YNO	Nicaragua
	Roumania
	Salvador
	Yugoslavia
	Venezuela
O	Aves Island
	Albania
1	(See 9H1)
	Gibraltar
(prior to 6-9-63)	British North Borneo
5	Palestine
3	The Gambia
4 (prior to -3-57)	Gold Coast, Togo
5, (ZS7)	Swaziland
7	St. Helena
3	Ascension Islands
	Tristan da Cunha and Gough Island
	Southern Rhodesia
1	Cook Island
1	Manihiki Islands

ZK2	Niue
ZL	Chatham Islands
ZL	New Zealand
ZL1	Kermadec Islands
ZL4	Auckland and Campbell Islands
ZM7	Tokelaus
ZP	Paraguay
ZS1, 2, 4, 5, 6	Republic of South Africa
ZS2	Prince Edward and Marion Island
ZS3	South-West Africa
ZS7	(See ZD5)
ZS8	Basutoland
ZS9	Bechuanaland
1S	Spratly Islands
3A	Monaco
3W8, XV5	Vietnam
4S7 (VS7)	Ceylon
4U1	I.T.U. Geneva
4W1	Yemen
4X4 (from 14-5-48)	Israel
5A	Libya
5B4 (ZC4)	Cyprus
5H1 (VQ1)	Zanzibar
5H3 (VQ3)	Tanganyika
5N2 (ZD2)	Nigeria
5R8 (FB8 Madagascar)	Malagasy
5T5, 5U7	(see after FF8)
5V	Tongolese Republic
5W 1(ZM6)	Samoa
5X5 (VQ5)	Uganda
5Z4 (VQ4)	Kenya
6N5	(See HL)
6O1, 6O2 (from 1/7/60)	Somalia Republic
6W8	(See after FF8)
6Y (VP5)	Jamaica
7G1 (from 1/10/58)	Republic of Guinea
7Q7 (ZD6, Nyasaland)	Malawi
7X2 (FA)	Algeria
7Z (HZ)	Saudi Arabia
8F (from 1/5/63)	Indonesia
8Z4	Saudi Arabia — Iraq Neutral Zone
8Z5 (9K3)	Saudi Arabia — Kuwait Neutral Zone
9A (MI)	San Marino
9G1 (from 5/3/57)	Ghana
9H1 (ZB1)	Malta
9J (VQ2 Northern Rhodesia)	Zambia
9K2	Kuwait
9L1 (ZD1)	Sierra Leone
9M2 (prior to 16/9/63)	Malaya
9M2 (from 16/9/63)	West Malaysia
*9M4 (VS1)	Singapore
9M6, 9M8 (from 16/9/63)	East Malaysia
9N1	Nepal
9Q5 (prior OQ5-0)	Republic of The Congo
9S4 (prior to 1/4/57)	Saar
9U5 (from 1/7/60 to 30/6/62)	Ruanda-Urundi
9U5 (from 1/7/62)	Burundi
9X5 (from 1/7/62)	Rwanda Republic

*French West Africa and French Equatorial Africa: Only contacts dated prior to when the particular area obtained separate listing (as shown) will count.

* One contact with each group formerly known as "Leeward Islands" and "Windward Islands" dated prior to 1/6/58 may be credited, in which case no further credit as a separate listing, as from 1/6/58 will be given those particular islands.

* From 16/9/63 to 8/8/65 counts as West Malaysia.

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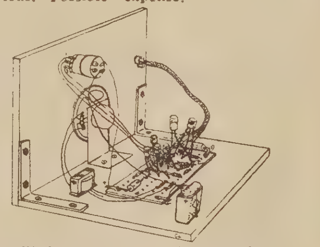

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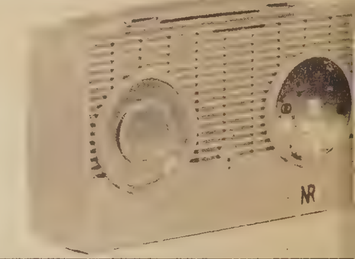

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1D8GT	95c	5V4G	$1.00	6K8G	68c	6U7G	45c	12SK7	50c
1K5G	40c	6B8	$1.00	6Q7G equiv. 6B6G	$1.00	6X5GT	75c	12SK8	50c
1K7G	49c	6C8G	50c	6SA7GT	95c	7C7	35c	12SH7	50c
1M5G	40c	6F6	$1.00	6SH7	55c	12AU7	$1.00	866	1.50
1P5G	25c	6H6	35c	6SJ7	95s	12AT7	$1.00	954	25c
1Q5G	25c							955	25c
1T4	45c							7193	25c
3Q4	75c							EK32	68c
EF50	45c							EL33	$1.00

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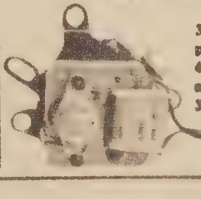

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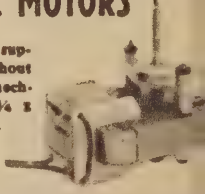

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0—50v	0—10v	0—1000v	
0—250v	0—50v	0—1MA	
0—500v	0—250v	0—100MA	

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The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg. in ½, 1 and 2 watt ratings and include some wire wound resistors. List price, $9.00 per 100. **Our price, $2.00 per 100.** Post and packing 25c extra.

The condensers are in most popular makes and include mica, ceramic, paper and electrolytic in standard values. List price, $11 per 100. **Our price, $2.06 per 100.** Post and packing, 35c extra.

The potentiometers are all current types and include switch pots, dual concentric and THB pots. List price, $12 per dozen. **Our price, $2.50 per dozen.** Post and packing, 25c extra.

FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Valve Type 6U7G or IT4 as advertised on this page.

New English Miniature 11 x 1 Switches

These new miniature eleven-position single-bank switches are 1" diam. with ¼" spindle, they have silver-plated contacts and high quality insulation suitable for H.F. use.

48c each. Post and packing 15c.

NEW GARRARD RECORD CHANGERS

These New English Garrard Changers with High Fidelity Crystal Pick-ups and Sapphire Styli have just been superseded. We are selling some at LESS THAN HALF PRICE. Available in STEREO at $25.50. POST AND PACKING EXTRA, N.S.W., $1.50; QLD., VIC., TAS., $2.25; W.A., S.A., $1.30.

HIGH-SPEED 240V. AC/DC MOTORS

These 240 v. a.c. or d.c. motors are 1/8 H.P. with a speed of 7,000 R.P.M. and are ideal for small drills, grinders, etc. Dimensions, 5½in x 3½in, with 5/16in spindle $3.75
Post, N.S.W., 50c; Interstate, 85c.

NEW 4-SPEED STEREO PLAYER F.O.R. .. $17.50 (£8/15/)

NEW STEREO CHANGER. 4-SPEED F.O.R. .. $21.50 (£10/15/)

SLIDER-SWITCHES
10 pole 2-way silver plated contacts 38c

TYGAN AND SARLON SPEAKER GRILLE FABRIC

54in wide. List price $6 per yard. To clear at $4 per yard.
Postage and packing, N.S.W., 35c; Interstate 45c.

LEADER SIGNAL GENERATOR LSG11

240V A.C. operated, 6 band 120KC to 390 Megs
Provision for crystal.
Post N.S.W., 75c; Interstate, $1.25. **$26.50**

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp., $3.75. Post, N.S.W., 20c; Interstate, 20c. Transformer for above rectifier tapped for 6 to 12 volt, with circuit for charger, $4.75. Post, N.S.W., 75c; interstate $1.00.
As above, 6 or 12 volt, at 2 amp., $2.75. Post, N.S.W., 35c; interstate, 45c. Transformer for above, $3.75. Post, N.S.W .,35c; interstate, 45c.

NEW 240V. A.C. MOTORS

These small motors, size 5in x 3in x 3½in, are 1-12 h.p., but are only suitable for intermittent use. $2.95. Post N.S.W. 35c; Interstate 50c.

THE NEW COLLARO 3-SPEED TAPE-DECKS 2 & 4 TRACK

The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

• 3-speed 1⅞, 3¾, 7½. • Pause control. • Takes 7in spools. • Simplified controls, 4 Track, $48; 2 Track, $44. OSC Coils, $150.

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools.
2 Track, $35.50. 4 Track 45.25.

NEW "TECH" V.T.V.M. MODEL TE65

23 RANGES. 240V. A.C. powered.

D.C.V. 1.5, 15, 50, 150, 500, 1,500
A.C.V. 1.5, 15, 50, 150, 500, 1,500.
D.B. −10db to +60db.
Resistance. 1 ohm to 1,000 megohm.

$42.50 **POST $1.00**

A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS

Using 3 silicon transistors as featured in October. Electronics Australia complete with kit of parts including transistors mono $7.50, stereo $13.00, 240 power supply for above $7.00.

25 WATT .. $53.75, £26/17/6
17 WATT .. $43.75, £21/17/6
Post Extra on 15 Watt
N.S.W., 10/; Interstate, 15/.
25 Watt by Rail or Air.
Too Heavy, for Post.

NEW 17 & 25 WATT P.A. AMPLIFIERS

The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves as microphone preamplifier and two EL34 valves Ferguson push-pull output.

All amplifiers are fitted with Ferguson output transformers with voice coil tappings of 2 to 15 ohms. The 25 watt amplifier can be supplied with line output transformer tapped from 100 to 600 ohms if required at 20/ extra.

Inputs provided for microphone, pick-up, and radio with mixing facilities and tone control.

The 15 watt is as above but using two 6BQ5 valves in push-pull output.

12in speaker for above (10 watt)	**$6.75**	**67/6**
Crystal Microphones for amplifier	**$4.75**	**47/6**

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

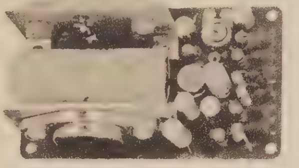
HAM RADIO SUPPLIERS

5A MELVILLE STREET, HAWTHORN, VICTORIA

Phone 86-6465 **ESTABLISHED 1947**

SINCLAIR Z-12 INTEGRATED HIGH FIDELITY PRE-AMPLIFIER AND 12 WATT AMPLIFIER

PRICE £9/15/ ($19.50)
inc. tax
POWER SUPPLY for Z-12: 6, 9, 12, 15 volts at 1 amp,
PRICE £7/17/6 ($15.75)
inc. tax



SPECIFICATIONS:
No. of transistors: 8.
Overall size: 3in. x 1.8in. x 1.3in.
Weight: 3oz.
Output power into 3 ohm load:
5 watts RMS continuous with 12-volt supply.
8 watts RMS continuous with 15-volt supply.
13 watts RMS continuous with 18-volt supply.
Output power into 1.5 ohm load:
10 watts RMS continuous with 12-volt supply.
16 watts music power with 15V. supply.
Power response: 1.5dB below 1KC at 20KC and 65 cps.
Frequency response: 15 c/s to 50KC plus or minus 1dB.
Input sensitivity: 2mV into 2Kohm.
Quiescent consumption: 12-volt supply—15mA.
Signal to noise ratio: Better than 60mA.
Total distortion: Less than one per cent.

SPEAKER BOXES

Plastic Speaker Box with 4in speaker and wire	55/	$5.50
Wooden Speaker Box with 6 x 4in speaker and wire	65/	$6.50

CHASSIS PUNCH SET

Hozan K-83 sizes 16, 18, 21, 25 and 30 mm. complete with taper reamer in wooden storage box	70/	$7.00

TRANSISTOR RADIO PARTS

To suit Zodiac, Grays, Tele-tone, Chevron, Lincoln, Retravision, Home Star and Vista (6 transistor radios).

Speaker 8 ohms 2¼in diam.	22/6	$2.25
Power capacity 200 mil watts. Gang with knob Capacity—Aerial section 6 to 142 PF Oscillator 6 to 60 PF	20/	$2.00
Aerial Coil on Rod	7/6	75c
Output transformer, 480 ohms to 8 ohms	15/	$1.50
Interstage transformer, 8000 ohms to 3000 ohms	12/6	$1.25
Oscillator Coil, 360 micro henry	8/6	85c
Potentiometer switched with knob, 5000 ohms	8/6	85c
6 Transistors and 1 Diode, 2-2N408/OC74N, 3-2N410/OC45, 1-2N406/OC71, 1-OA90	82/6	$8.25
3-IF Transformers, 455 K/C	30/	$3.00
Complete set resistors and condensers (32)	42/6	$4.25
Printed Circuit Board	10/	$1.00
Cabinet complete with earphone Jack, earphone and carrying cases	25/	$2.50

COAXIAL CONNECTORS—AMERICAN TYPE

PL259 Coaxial Plug	9/6	95c
4087-1 Coaxial Plug (PL259, PTFE)	14/6	$1.45
S0239 Coaxial Socket (suit PL259)	9/	90c
4802-1 Coaxial Socket (PTFE)	14/8	$1.47
C32-14 Coaxial Dble ended female cable joiner (PTFE)	17/6	$1.75
UG175U Adaptor for PLT59 to suit ¼in cable	2/9	28c
C32-17 Coaxial "T" Piece, Suit P1259	23/3	$2.32
BNC SERIES:		
UG88 CU Coaxial Plug (PTFE)	15/9	$1.58
UG290/U Coaxial Socket (PTFE)	12/6	$1.25
BELLING LEE TYPE:		
Coaxial Plug (suit ¼in cable	4/	40c
Coaxial Socket	3/6	35c
Coaxial Socket (flush mount)	3/6	35c
Coaxial Cable joiner (female)	4/	40c

PARTS FOR RTV & H TACHO

Meter (MR3P) 0-1 m/a	50/	$5.00
7000 or 5000 r.p.m. scale, extra	15/	$1.50
Henry choke ready wound	22/6	$2.25
I.K. trimmer pot	4/	40c
Circuit board	6/	60c

"HI-SPARK" TRANSISTOR IGNITION SYSTEM

12TN 12Volt negative earth Inc. Tax.	£16/10/	$33.00
6TN 6Volt negative earth Inc. Tax.	£16/10/	$33.00
12TP 12Volt positive earth Inc. Tax.	£20/10/	$41.00

Complete replacement system, contains transistor unit, special ignition coil, ballast resistor, wire, and installation hardware.

VARIABLE CONDENSERS EDDYSTONE (CERAMIC) ¼" SHAFT

580 Condenser	13.5 pf	22/6	$2.25
582 Condenser	63 pf	25/	$2.50
584 Butterfly Cond.	32x32 pf	25/	$2.50
585 Condenser	91 pf	27/6	$2.75
586 Condenser	140 pf	38/6	$3.85
817 Transmitting Cond.	270 pf	52/6	$5.25

ROBLAN BROADCAST GANGS

RMG1 Single Gang,	10-50 pf	18/6	$1.85
RMG1 Single Gang	10-415 pf	18/6	$1.85
RM92 2 Gang	10-415 pf	25/	$2.50
RMG3 3 Gang	10-415 pf	33/6	$3.35

ROTARY SWITCHES (JABEL)

3 pole 3 position	10/	$1.00
4 pole 3 position	10/	$1.00
2 pole 6 position	10/	$1.00
1 pole 12 position	10/	$1.00

BATTERY CHARGERS DUAL

COMPLETE WITH METER IN METAL HAMMERTONE CASE

6 volt 4 amp ($15.75) 12 volt 6 amp ($21.75)
12 volt 4 amp ($15.75) 6 volt 6 amp ($21.75)

RECORDING TAPES WELL KNOWN MAKES BRAND NEW IN CARTONS

150 ft on 3 inch reel Acetate	6/	60c
225 ft on 3 inch reel Acetate	7/6	75c
300 ft on 3 inch reel Tensilised Mylar	12/6	$1.25
500 ft on 3 inch reel Tensilised Mylar	16/6	$1.25
600 ft on 3¼ inch reel Tensilised Mylar	16/6	$1.65
600 ft on 5 inch reel Acetate	17/6	$1.75
900 ft on 5 inch reel Acetate	19/6	$1.95
900 ft on 5 inch reel Mylar	22/6	$2.25
1200 ft on 5 inch reel Mylar	35/	$3.50
1800 ft on 5 inch reel Tensilised Mylar	52/6	$5.25
850 ft on 5¾ inch reel Acetate	17/6	$1.75
1200 ft on 5¾ inch reel Mylar	35/	$3.50
1800 ft on 5¾ inch reel Tensilised Mylar	52/6	$5.25
2400 ft on 5¾ inch reel Tensilised Mylar	70/	$7.00
1200 ft on 7 inch reel Acetate	27/6	$2.75
1200 ft on 7 inch reel Mylar	32/6	$3.25
1800 ft on 7 inch Acetate	37/6	$3.75
1800 ft on 7 inch reel Mylar	45/	$4.50
2400 ft on 7 inch reel Mylar	52/6	$5.25
3000 ft on 7 inch reel Tensilised Mylar	75/	$7.50
3600 ft on 7 inch reel Tensilised Mylar	92/6	$9.25

EMPTY TAPE REELS

3 inch	2/6	25c
3¼ in	3/6	35c
4 inch	3/6	35c
5 inch	4/	40c
5¾ inch	5/6	55c
7 inch	5/	50c
OR IN PLASTIC STORAGE BOX		
5 inch	8/	80c
7 inch	12/	$1.20

TRANSISTOR SIGNAL INJECTOR

Pencil type 2 transistor, complete with instruc tions and battery	55/	$5.5

POLYPAK SPECIALS

100 assorted new, resistors, condensers, poten tiometers, popular types	17/6	$1.7
100 new assorted paper, dielectric, metalpa capacitors, popular types	15/	$.15
30 assorted new resistors, condensers, potentio meters, popular types	10/	$1.0
20 polyester, paper, ceramic, plastic and elec trolytic condensers, popular types. New	10/	$1.0
20 polyester, styroseal capacitors, All ne popular types	10/	$1.0

BEZALS AND NEON INDICATORS

Sato 3280 6-8 volt subminiature, red, gree blue	4/6	45
NEZ Neon indicator 65 volt flying leads	3/	30
230 volt red Neon bezal	6/6	65

POWER TRANSFORMERS

1992 150V-0-150V 30 M/A 6.3V-1.75A	37/6	$3.7
1993 225V-0-225V 50 M/A 6.3V-2 amp	45/	$4.5
2062 Voltage doubler 290,265V. D.C. 80 M/ Primary 6.3 Volt C.T. 2.25A Secondary	67/6	$6.7
2064 Voltage Doubler 340,315V. D.C. 125 M/ Primary 6.3 Volt C.T. 2.25A Secondary	87/6	$8.7
2067 Voltage Doubler 310, 285, 260V. D.C 100 M/A Secondary 6.3 Volt C.T. 4 am Primary	83/6	$8.3
290V-0-290 Volt 60 mA, 6.3v 2A, 5v 2A	27/6	$2.7
385v-0-385 volt 100m A, 6.3v 3A, 5v, 2A	35/	$3.5
385v-0-385 volt 125mA, 6.3v 3A,6.3c 2A, 2A	45/	$4.5

AUDIO TRANSFORMERS

2624 7000 ohm SE 500 ohm SE Primary 3.7, 8, 15 ohm secondary	46/	$4.6
4013 15 watt 6600 ohm C.T. 20 p.c. primar 3.7, 8, 15 ohm secondary	164/8	$16.4
4020 10 watts primary 9000 ohm C.T. 20 p. Ultra Linear (Mullard 10-10) Secondary 3. or 15 ohm.		

TRANSISTOR TRANSFORMER

TD1 Driver 3000 ohm-2000 ohm C.T.	19/6	$1.9
TD2 Driver 420 ohm C.T.-105 ohm C.T.	19/6	$1.9
TO1 output 375 ohm C.T.-3.5 ohm 500 MW	16/	$1.6
TO2 Output 97 ohm C.T.-3.5 ohm 1 watt	18/6	$1.8
TO4 Output 300 ohm C.T.-3.5 ohm 5 watt	37/6	$3.7

FILAMENT TRANSFORMERS

T 4/4 230V-6.3V 2 amp	32/6	$3.2
2150 240V-6.3V-2.5 A or 2 x 6.3-1.25A	35/	$3.5
2155 240V-6.3V, 7.5, 8.5, 9.5, 12.5, 15V lamp	46/	$4.6
12/64 240V 6 volt 4 amp-12 volt, 4 amp	50/	$5.0
12/66 240V 6 volt 6 amp-12 volt, 6 amp	57/6	$5.7
Power filter choke. Special 14 Henry 60 M/ 12/6 to clear		$1.2

SPEAKERS—WELL KNOWN

MAKE, BRAND NEW, BANKRUPT STOCK

2in	15ohm	30/	$3.0
3in	15-3.5	32/6	$3.2
4in	15-3.5	37/6	$3.7
5in	15-3.5	40/	$4.0
6in	15-3.5	45/	$4.5
5in x 7in	15-3.5	47/6	$4.7
8in	15-3.5	52/6	$5.2
9in x 6in	15-3.5	55/	$5.5
12in	15- or 3.5	82/6	$8.2

WIDE RANGE LOUDSPEAKER

5in Twin Cone Tweeter 15 watts RMS (400 cps to 16 K/c)	45/	$4.5
6in Twin Cone (60-16000 C/s) 5 watt, avai able in 8 or 16 ohms	50/	$5.0
8in Twin Cone (50-16000 C/s) 10 watt, avai able in 8 or 16 ohm	75/	$7.5
12in Twin Cone (45 C/s-10 K/c) 10 wat available in 3.5 or 15 ohm	100/	$10.0
12in twin cone (30-13000 C/s) 20 watt, avai able in 8 or 16 ohm	195/	$19.5

LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

Radio Canada's "Expo 67" Contest

Radio Canada has announced details of a contest to celebrate next year's centennial of the Dominion, with 26 return flights to Montreal, site of the "Expo 67" exhibition, as major prizes for contest winners.

The contest is being run in two sections. members of the Radio Canada Short ve Club, the design of a verification d to be used during the centennial year the theme, with two return seats by to Montreal as the prize, while all rt-wave listeners can enter an essay comition which has 24 return air flights as prizes.

All members of the Radio Canada SW ib will receive the contest rules in the il, as well as new members accepted the club up to October 1, 1966. Details ut the QSL verification card design itest can be had from the Secretary, dio Canada SW Club, Box 6000, Monal, Canada. The theme of the QSL card ign must link Radio Canada with the ion's centenary.

The general contest, open to any shortve listener, is for an essay on the theme the Expo 67, "Man and His World." e prizes here include 12 double airline kets, accommodation in Montreal, free ry into Expo 67 and a daily allowance incidental expenses. In addition radio eivers, tape recorders and short-wave lios will be given to minor prize-winners. special form, available from Centennial mpetition, Radio Canada, Box 6000, ntreal, Canada, must be used by intend- entrants to the competitions.

Changes in the Radio Canada schedule lude the use of a third frequency to European area, which carries the same gram as the one beamed to the South cific. The service to Europe is on 55KC and is to operate 0730-0815GMT relay by BBC London for reception in st Africa. The Australasian service conues on 5970 and 9625KC, from 0730 0830GMT. The Montreal service to rica, 1830-2000, is now on 17820, 15320, 720KC. The European service is 2000-45 on 15320, 11720 and 9630KC. The nsmission to the Caribbean, and United ites is operating on 15190, 11725 and 25KC from 2300.

The new service to West Africa is being ayed by BBC London on 17715, 15390, 925KC for the period 0730-0815, with same program as the Australasian vice.

RADIO BERLIN—15255KC

After many weeks of using 15255KC thout any announcement by the station, dio Berlin International is now announc- this channel as being in regular operan. The station is on the air 1200-1300 well as 15240KC, but the best signals on 15255KC at 1530-1600GMT. The nsmissions on Wednesday include the ws that letters from listeners are answered the session of that day, and that these me from Australia, New Zealand and Asian area. Radio Berlin International quests reports on this transmission to its uth Asian Section, Radio Berlin International, Berlin, East Germany.

SOVIET EXPANSION

The Soviet Union has announced the expansion of its radio broadcasts in Central Asia, boosting Radio Alma-Ata's transmitters to reach effectively into China. The new transmitters in the expanded broadcast centre will be capable of six broadcasts simultaneously instead of the three programs previously carried.

NEW VATICAN SERVICE

Vatican Radio, in common with many other broadcasters, has increased its service to Africa with transmissions serving the area for both morning and afternoon reception. The morning service at 1000GMT has been in operation for several months on 21485KC and in our summer provides excellent reception, with a repeat session at 1040GMT. The new service for Central and East Africa is on the air at 1700 and again at 1740GMT and is on 15120 and 11875KC. The latter is a new frequency for Vatican Radio. Vatican's service to the Pacific is now best received at 2200GMT on 11735 and 9670KC, both of which provide strong signals. The other transmission at 1130GMT is poorly received in the winter in the Australasian area.

SCHEDULE IN ENGLISH FROM PARIS

The news bulletins of ORTF in Paris, France, reported in our last issue as being heard at 0445GMT on the new channel of 9500KC, are part of an additional service in English which is now being carried by Paris and the Brazzaville relay station, according to a verification to hand from the station. The verification card is a new one, showing the ORTF Paris Broadcasting House in the foreground and the skyline of Paris in the background.

English transmission from Paris and the Brazzaville relay are as follows:

Time, GMT	Frequency, KC
0445-0500	7100, 9500
*0515-0530 and *0615-0630	15445, 11725, 9730, 5970, 4795, 3232
1020-1035	15160, 21580
*1100-1115	15445, 11970
*1300-1330	21580, 21500, 17720
1900-1930	11845, 11885, 15130
*1915-1930	15190, 11930, 9730, 7105, 5970, 3230

Note: * indicates relays by Radio Brazzaville of ORTF programs.

RADIO NEW ZEALAND

A major change in Radio New Zealand broadcasts from Wellington is the replacement of 11780 by 6080KC in the Australian service. Transmissions are on the air as follows.

To the Pacific Islands.

1700-1945GMT	9540,11780KC.
2000-0545	15280.
0600-0845	9540,11780.

To Australia.

2245-0545	11780.
2245-0545	15110.
0900-1145	9540,6080.

To Antarctic.

0815-0845 Sunday	6080.

PERCEPTION REPORTS

The switch from the old QSA code to the SINPO code is now universal, and some broadcasters have reduced the latter to the SIO code, used by BBC London, and also CBC Montreal. The signal is divided into three sections, Signal, Interference and Overall Merit, hence the designation S.I.O.

Recently Jim Paris, of Adelaide, wrote to the BBC about the code, since he felt, as we do, that reports of reception of a 555 signal frequently given by some short wave listeners were a little exaggerated, since a 555 signal relates to perfect short wave

New Zealand Broadcasting Corporation's new Broadcasting House building in Wellington. Programs for Stations 2ZB, 2YA, 2YC, 2YD, 2YB and Radio New Zealand originate in this building.

SOUND PROJECTORS

Cinevox Prefect 16mm in good working order. 240v operated, complete with speaker and amplifier.

$95.00

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.

$1.25 each. Post 10c.

REFLECTOR GUNSIGHT

Contains these lenses:
1 Lens 1in Focus, 1½in diam.
1 Lens 1 11/16in Focus, 1¼in diameter.
1 Air-spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule.
1 Lampholder.

$1.85 each

Post.: N.S.W. 30c; Interstate, 40c.

PMG TYPE TELEPHONES

Standard desk type with magneto calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line. Complete with 660ft wire.

$23.00

(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

AERIAL CAMERAS

F.24 Mark IV 2.9 Lens, stops 11, 8, 5.6, 4, 2.9.
With 3" x 8" F1 Dallmeyer Lenses complete with wooden case.

$39.00

50c Cartage to Rail, Freight payable at nearest attended railway station.

WALL CLOCKS

Smiths electric or 8-day wind-up, slightly used but perfect.

8in dia.	$ 9.50
9in dia.	$ 9.75
12in dia.	$11.50

Post 50c N.S.W. Interstate 75c.

TRANSFORMER

AGC. Single phase, 1.75 Kva primary volts, 100-200, 110-220, 120-240, 130-260, secondary, 2,200 1,700 at FL. PF equals 1.0. $35.00.

12 CREED TELEPRINTER

Tape printers model 47.R 240 Volts operated.

$35.00

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire. 1,320ft coil of twin (equal ½ mile). $7.00 per coil.
Post., N.S.W. 70c; Interstate $1.20.

3000 TYPE RELAYS

P.M.G. 200 Ohm — 1,500 Ohm Coils, $1.25 each.

2-WAY RADIO

NUMBER 22 (AUST.)

Untested without meter or leads, with power supply less relays. $15.00. 50c cartage to rail. Freight payable at nearest attended railway station.

A.W.A. 6 or 12 volt

Transmitter 70 to 80 megocycles $15 240 volt power supplies for receivers. $15, 50c cartage to rail. Freight payable at nearest attended railway station.

POCKET 420 M/CS RECEIVERS

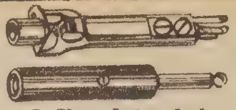
Contain 6 transistors and 3 diodes, pot cores, resistors, etc. Suit conversion to other frequency or for "Foxhunt Sniffers."
Complete in case 3in x 5in x 1in.

$10.00

AWA OSCILLOSCOPE

Calibrated with delay time base 5in, 240 vac, perfect.

$195.00



P.M.G. Phone Jack and plugs 25c each, 45c the pair.
Post 7c.

NIFE CELLS

1.2 Volt fully charged, 4in x 3in x 1in 4 AH.

$1.00 each

Post. N.S.W., 25c; Interstate 35c.
1.2 volts 15 AH, 8in x 4in x 2in $2.95.
2.4 volt 10 AH. 6in x 2½in x 2in $2.50.
Post N.S.W. 30c. Interstate 40c.

PERSPEX

Slightly domed shape, 16in x 12in, $1.55. 2ft 6in x 18in tapering to 6in, $1.75. 2ft 6in x 2ft, $2.45. Domed approximately 3ft 6in x 2ft, $5.50.
50c cartage to rail. Freight payable at nearest attended railway station.

P.M.G. TYPE KEY SWITCHES
45c each. Post 15c.

VALVES

BRAND NEW

IN CARTONS

Special discount for quantity

6SN7GT	95c	6AG5	50c
89	$1.00	X61M	$2.20
12SA7	$1.25	CV850	75c
6H6	45c	18H6G	30c
41	$1.25	832	$5.00
5U4G	95c	6F13	75c
77	$1.00	6AK5	$1.75
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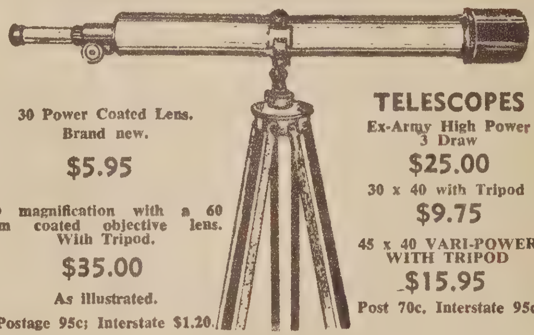

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eption, such as would be obtained from ocal broadcasting station.

n reply, Mr Henry R. Hatch, of the C Engineering Division, said it appeared t most listeners take into consideration distance of the station from the listener, ce they have the idea that some slight dit should be given for this.

Hatch recalled that when was at the BBC Monitoring Station, monitored Radio Australia as a 555 nal. He was then told by his supervisor t such a signal must be excellent, with fading or interference, free from all se and equal to studio quality. By these ndards, the signal was not excellent, but had made it higher in its rating because transmission had originated 10,000 miles m London.

f we are honest with ourselves, we must nit that it is seldom any station reaches signal level. The BBC reporting forms ve recently been altered to cover the merit ues 2, 3 and 4, denoting poor, fair l good reception. The "excellent" rating has been deleted from BBC log forms. Although signals do sometimes qualify an excellent rating, one must guard inst letting the merit value become high, h consideration of the distance, propa- ion conditions and other factors being put use in the final assessment of signals.

My own observations show that seldom in ne 25 years have I given the BBC a rit 555 signal, yet the signals from Mon- al, when monitored, often qualify for this rating. Here we have two different trans- sions and the signal strength, lack of erference, all phases of reception from ntreal, with its direct path, is often erior to most other short wave signals we receive.

V.O.A. EXPANSION PROGRAM

Details on the expansion of the United tes Information Agency's Voice of erica transmitters at overseas relay es have been announced. The new relay es Thailand, Philippines and Greece are be expanded. The Philippine construction, h 10 transmitters of 25KW, is under y and this will be added to present V.O.A. ilippines stations which include a mil- watt BC transmitter, two of 100KW, two of 25KW on shortwave. The ece installation will include 10 short ve transmitters of 250KW and one KW outlay on broadcast band. At sent the V.O.A. combined total of its rseas relay stations is 5,715,500 watts, the organisation now broadcasts in languages.

THE TARGET AREA

ome of our readers have asked why, en a station is broadcasting to a speci- l area, is reception often possible in er parts of the world, and in the reverse, y a program on frequencies which are beamed to the Pacific area at all are eived well in Australia and New Zealand, h comparable signals.

ome listeners wonder why a particular ion does not serve the Pacific with one gle powerful transmitter instead of a nber of weaker ones. This is a wrong essment of the situation. To serve a par- lar area, broadcasting bodies generally one powerful transmitter, the power put of which is regarded as adequate serve the area in question when the sig- s are beamed in that direction. If signals m the same source are received in that a on other channels with comparable ngth and clarity, this is quite uninten- al.

n the case of BBC Pacific area broad- ts from London, the major factor is that nsmitters on various wavebands are med to different countries, but on the e general bearing or path from London. Edward Bowmont, of the BBC Engineer- , recently stated that the lower frequency ds were used to serve the nearer areas, the higher frequencies the more dis- t areas. There is no way of stopping the mer from continuing on and also serving distant area, which is beyond the area re it is intended to give maximum reception. Secondly, though the directional properties of the BBC aerials are very high, a considerable amount of power is nevertheless radiated in directions other than to which the signal is being beamed. It is therefore often possible in a specific area to hear a number of transmitters not beamed to that area, but this can be regarded as a mixed blessing. It is an advantage to be able to hear signals on a number of bands, as due to day-to-day propagation condition changes, which favour different bands on different days, it is necessary to try other bands when conditions are unfavourable on the usual best received frequency. On the debit side, we must consider the interference between stations using the same frequency when the signals from one are received in the service area of the other at comparable strength. Although these interfering signals are beamed to another area, where no station is operating on the same frequency, they quite unintentionally find their way to areas where they interfere with stations that are using the same frequency.

The power radiated along the central main beam of most BBC transmitters has been in the order of 4000KW, and it is becoming increasingly difficult and costly to increase this power. Nevertheless new higher power transmitters are being installed by the BBC at the present time, and so listeners should note a substantial increase in the signal strength of many BBC transmitters in the target areas.

RADIO AUSTRALIA'S NEW SCHEDULE

Some changes have been made in the transmission times of Radio Australia. These include a retiming of the British transmission, shortening of that to North America, and extension of transmission times to Africa. The evening transmission to North America has been shortened by 45 minutes, and is now broadcast 0100-0300GMT, using 15220 and 17840KC. To Africa the transmission is extended by 30 minutes, and now commences at 0330GMT, on 15220 and 17820KC. To the British Isles and Europe, the transmission is 0645 to 0745GMT on 11710 and 9560KC.

The service in Indonesian has made a frequency change and is now being broadcast on 11780KC instead of 11760KC, in the session 2245-2345GMT.

The program, AUSTRALIAN DXERS CALLING, is now broadcast on Saturday at 1930 and 2200GMT, on Sunday 0500, 0730, 1300, 1530, and on Monday at 0245GMT.

FLASHES FROM EVERYWHERE

RED LION, Pennsylvania, is the site of WINB, the International Broadcaster which has been in operation for more than two years now. The WINB station is on the air in English at 1700GMT. They open on 17720KC to 2000GMT. Transmission continues on 11795KC from 2002-2200GMT. The program of news and features includes a large part of gospel programming.

UNITED NATIONS RADIO in New York is reported to be operating, and has a half-hour for Europe at 1800GMT, which includes features in six languages. The transmission is on 15250 and 9710KC each Friday. The UN Radio program on Saturday 0230-0245 is for Malaysia on 17705 and 15185KC. The transmission to Australia-New Zealand on Saturday is 0845-0900 on 9520, 5985 and 11845KC.

ECUADORIAN station HCJB is giving good reception of 15405KC with its transmission in Spanish to 2200GMT. The station then announces it will continue to broadcast on 17890 and 15115KC with programs in Spanish and the frequency of 15405KC is then taken out of service. Signals are good in New Zealand, but back radiation often makes the quality poor, due to the effect of transmissions being received over differing paths and the echo effect on the signal.

CAIRO has made an alteration in time and frequency for its service to South Asia, reports Ernest Suffock, of South Australia. The former transmission at 1330GMT is replaced by one at 1300GMT and the frequency 17920 formerly used is replaced by 17690KC. The station has news in English 1315GMT, and this retiming has been also noted in the former 2130GMT transmission now on at 2100GMT, on 11915 and 9475KC.

CAMBODIA is now giving its English schedule as two English newscasts on 5930KC at 0530 and at 1245GMT. The station reports other frequencies in use, and we have noted the transmissions are also carried in the 49M bands. On BC, the best reception is on 1434KC, but interference from 2WL Wollongong is severe at this time. A verification from the Voice of Cambodia is seldom issued and despite our reports by airmail, registered mail and with an International Reply Coupon enclosed they have failed to produce the long-awaited verification.

SAN FRANCISCO station KGEI is on a new schedule. The station broadcasts to Latin America in Spanish and English and opens 2215GMT on 15240KC, with all transmissions in Spanish except the period 0005-0030 week days. English is carried 0145-0200 and then the station sign off is 0200, opening at 0201GMT in Spanish, the frequency of 15240KC being altered to 9715KC. The Spanish on 9715KC from 0201GMT continues, except for English 0305-0330, 0445-0453, when the station closes, except on Sunday, when sign off is 0340.

ETHIOPIA'S ETLF in Addis Ababa, the Voice of the Gospel, is being heard on the new frequency of 11910KC with a program in Arabic to the Middle East from 1700 to sign off with English identification at 1825GMT. Another frequency we have noted is 11775KC and this one is heard in English on Tuesday, Wednesday and Thursday to sign off at 0455GMT.

MONROVIA in Liberia is reported by a South African listener to be using the 13m band for the transmissions of ELWA, the gospel broadcaster. The new station frequency, 21535KC, is reported to be on the air 1615-1845 when the power of 1000 watts is used on this channel.

TANANARIVE in the Malagasy Republic which has had a 100KW transmitter for some months has at last been heard in New Zealand. Barry Williams of Auckland reports reception of test transmissions from Tananarive, and with announcements in French and English, using 15270KC. The station has been heard 1600-1700GMT asking listeners for reports on the signals.

RADIO NEW YORK World Wide, WRUL, has bought a new building at 485 Madison Avenue, New York, the former home of the Columbia Broadcasting System. When Radio New York World Wide makes this move, the increased facilities should get it even better presentation on shortwave radio, and its connections with the American Broadcasting Company enable it to maintain a high standard of news presentations.

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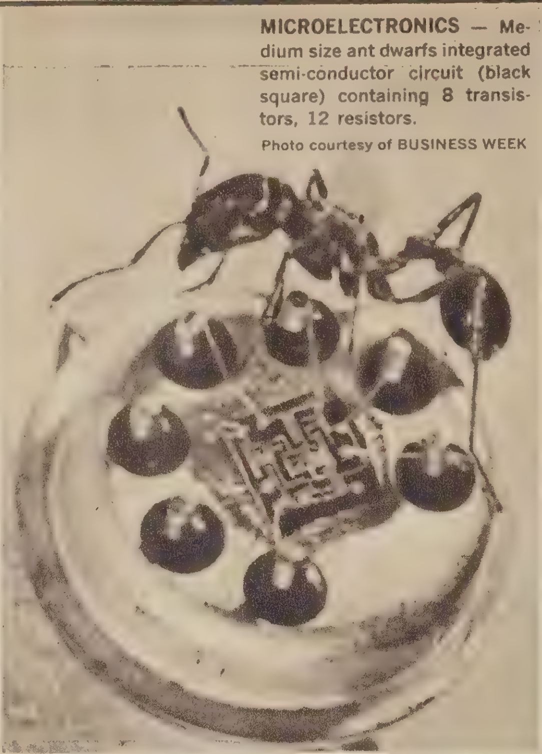

MICROELECTRONICS — Medium size ant dwarfs integrated semi-conductor circuit (black square) containing 8 transistors, 12 resistors.

Photo courtesy of BUSINESS WEEK

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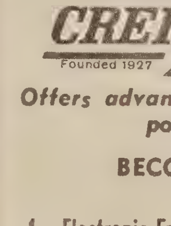

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BURMA Broadcasting Service at Ran
is reported by August Balbi, of
Angeles, USA, to be heard on 504
with English from 1430 to 1600G
News is broadcast at 1445GMT, and
program has also been heard irregu
on 7055KC.

ATHENS in Greece is reported to be
laying programs of Deutsche Well
Cologne, for reception in North Ame
The transmission time is 1045-1100G
and the frequency 9605KC. The re
announcement in this page that Deut
Welle in Cologne were seeking a site
a relay base in south-east Europe c
mean that this new station will be
in Greece.

HAITIAN station 4VEH, a gospel br
caster, located at Cape Haitian, is now
the air 1030-1400, 1700-0130, with Eng
1130-1400 and also 1900-2100 on Sun
in French 1700-2001 on weekdays
2300-0130, and in Spanish 1030-1130
2100-2300GMT. Frequencies used
11835, 9770, 6120, 2450 and 1035KC
BC.

PARIS, in the ORTF transmissions,
been heard on 5955KC at very
level from 0800 to 0900GMT in a Fre
transmission beamed to New Caledo
This transmission was formerly at 0
0645, but the new time gives good re
tion on the two frequencies used. H
ever, 9560 is mixed with Radio Austr
Melbourne, which moved to this
quency to avoid interference from M
rid on 9570KC, but now has interfere
from Paris at this new transmission ti
The use of 5955KC also causes inter
ence to Radio Canada in its transmiss
to Europe for the period 0800-0815 w
both stations use the same frequency.

**NOTES from readers should be sent t
ARTHUR CUSHEN, 212 Earn Stree
Invercargill, N.Z. All times are Green
wich Mean Time, add 8 hours fo
Perth, 10 hours for Sydney, 12 hour
for Wellington time. All frequencie
are in kilocycles.**

MADRID, with its Radio Nacional
Espana transmissions to Latin Amer
are observed on 11715, 9570 and 9368
to sign off at 0500GMT. This freque
of 9570KC replaces 9695KC,, which
been used in the past. All the progra
in Spanish.

BRAZILIAN stations continue to be he
in our early evenings, and Bob Pad
of Melbourne reports the reception
ZYR63 Sao Paulo on 6025KC which
been heard at 0800 in the usual Portugu
program. Radio Tupi ZYC7 in Rio
Janiero on 6115KC has also been he
at 0800GMT after B.B.C. London cl
on 6110KC. Radio Nacional in Sao Pa
PRG9 on 6125KC is at fair level, w
PRC21 at Porto Alegete on 6135KC
been noted at 0845GMT.

ANDORRA station Andorra Internati
is seldom reported, but reception
now possible from 0730-0800GMT,
5995KC. Before this time the transmiss
is blocked by the V.O.A. Greenville
tion with its Breakfast Session.

Broadcast Band News

AUSTRALIA — The latest Austral
Broadcasting Commission station in op
tion is 4QD Emerald, Queensland, wh
opened at the end of January on 1550
with 50KW. The station gives excellent n
time reception in New Zealand. The sta
uses the last vacant channel in the A
tralian broadcast band, with the excep
of 570KC, which is currently used by 2
Wellington. The next Australian station
come on will also be in Queensland,
the new Cooma (N.S.W.) station is
scheduled for operation late this year.
station, which will operate on 1570KC
50 watts, will be a transistorised tr
mitter to operate unattended and r
A.B.C. programs into the Cooma area.

TECHNICAL BOOKS AND PUBLICATIONS

TEGRATED CIRCUITS, Design Principles and Fabrication. Edited by Raymond M. Warner, Jr., and James N. Fordemwalt, Semiconductor Products Division, Motorola Inc. Published by McGraw-Hill Book Co., New York, 1965. 370 pp., 6 x 9in, hard covers. 298 illustrations. Price in Australia $13.15.

'his volume is the first of two on inte- ted circuits, based on an intensive course sented to the U.S. electronics industry by torola's Semiconductor Products Divi- i, with the professed aim ". . . to elerate the understanding and acceptance :his new art." The present volume is con- ned with circuit design from the stand- nt of device and process properties and itations.

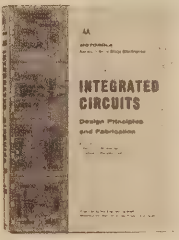
lthough this might suggest that the book omewhat too exotic and specialised for general reader at student or engineering el, this is by no means the case. In fact, examination reveals it as a most com- hensive textbook of modern semiconduc- technology in virtually all of its aspects.

'he book is divided into three main sec- ns. The first of these, some 120 pages in gth, deals with semiconductor and tran- or fundamentals. In four chapters this tion discusses basic semiconductor 'sics, junction theory and properties, im- ity diffusion and diffused junction pro- ties, and basic transistor engineering.

'he second main section is devoted to the nciples of integrated circuit design. Chap- in this section deal with the basic pro- ses and design of monolithic and hybrid cuits, multiphase monolithic circuits, the orporation of monolithic transistors and des, integrated field-effect devices, other ive devices and passive components.

'he final main section deals with the rication of integrated circuits. Chapters e deal with crystal growing and the epitaxial process, wafer processing, thin films and their fabrication, assembly processing, and packaging methods and processes.

Throughout the book the treatment is commendably consistent at a practical but thorough engineering level. The text is logical in exposition, lucid in style and well supported by an abundance of clear illustrations. By "practical engineering level" I mean here that while assuming a fairly advanced engineering background it is not restricted to "ivory tower" mathematical or theoretical concepts or models. Along with the theory and formulae there are plenty of illustrative practical implications.



In addition to these formal qualities it has the important advantage that the content material is up-to-date; or if you like, as up-to-date as any textbook can be in modern electronics. In six month's time it might well be olde worlde, I grant you, but at least it isn't in this (overflowing) class at present. For those who find their texts ignorant on such topics as epitaxial deposition, multiple diffusion, passivation, multiphase monolithics, "purple plague," and recent advances in packaging and interconnection, this will be an important point.

In short, this reviewer finds "Integrated Circuits" a most comprehensive and illuminating textbook of modern semiconductor theory and technology. It may be heartily recommended both to the senior engineering student and to the practising engineer.

If it is still possible for electronics texts to become "classics," this one is surely destined to become so. (J. R.)

IE RADIO AMATEUR'S HANDBOOK, 43rd edition. Edited by Byron Goodman, WIDX. Soft cover, 690 pages, 9½ x 6½in, well illustrated, with diagrams and photographs. Published by the American Radio Relay League, Newington, Conn., U.S.A. Australian selling price $5.85 plus 30c postage.

Like Christmas, the A.R.R.L. Radio Ama- r's Handbook comes around once every ir. Usually this publication has minor inges in each edition which does not courage an annual purchase. However edition has dropped some of the older istruction articles and replaced them with ne interesting new articles. Amongst these v articles are a Four-Transistor Regenera- Receiver, a Three-Band Con- ter, Transistorised Selectojet, Mechanical ter Sideband Exciter, Strip Line Converter 432MC, and others.

Besides the changes in constructional icles, some rewriting has been done in general theoretical side. Instances of this the discussion of the 7360 valve as a eiver mixer and additional notes on dio-teletype equipment.

Potential purchasers of the handbook o have not seen previous issues might to know that it has a section on theory ich covers from elementary principles, ctrical laws and basic circuits through uum tube principles, semiconductors, lowed by chapters dealing with the con- ıction and operation of radio equipment the amateur bands, A section at the k of the handbook lists characteristics and socket connections of modern valves and transistors.

For both the beginner or the established amateur, the A.R.R.L. Handbook is an excellent reference book and this particular edition is well recommended. Copies were to hand from the publishers and also the Technical Book and Magazine Company Pty. Ltd., 289-299 Swanston Street, Melbourne, Victoria. (K.W.).

★ ★ ★

TECHNICAL TOPICS FOR THE RADIO AMATEUR by J. Pat Hawker. Soft cover, 100 pages, 9½ x 7½in. Published by the Radio Society of Great Britain, 28 Little Russell Street, London, W.C.1. Australian price $1.90 plus postage 12c.

A wealth of information interesting to the radio amateur has been published over the past seven years in the R.S.G.B. Bulletin and other publications. The author has expressed the desire to accumulate the cream of the ideas presented in a categorised form with sufficient detail to enable most amateurs to apply them in building or rebuilding existing equipment.

The resulting publication has been divided into nine sections as follows; Semiconductors, Components and Construction, Receiver Topics, Oscillators, Transmitter Topics, Audio and Modulation, Power Supplies, Aerials and Electrical Interference, Fault-finding and Accessories.

Each chapter is profusely illustrated and the information given is in simple technical language for easy assimilation. If you wish to add a product detector to your receiver or a Q multiplier, ascertain the noise figure of common RF amplifiers and mixers, or build a new VFO, then among the pages of Technical Topics there will be found some suitable circuits and advice.

At the price quoted the reviewer feels that this book is a small gold-mine for the active radio amateur. Our review copy from Technical Book and Magazine Company Pty. Ltd., 289-299 Swanston Street, Melbourne, C.1., Victoria. (K.W.).

★ ★ ★

1966 WORLD RADIO TV HANDBOOK. Soft cover, 304 pages, 8½ x 6½in Published by World Radio TV Handbook Co., Ltd., Hellerup, Denmark. Australian price $4.50 plus post 15c.

This is the 20th edition of an annual publication which from modest beginnings has achieved international recognition as a reference work and directory of radio and television activity in all parts of the world. With the co-operation of broadcasting authorities in most countries of the world, the publishers attempt to give a complete listing of radio and TV stations in operation at the time of publication.

For short wave listeners all over the world it has become almost the "bible" of radio, since it gives details of frequency, programs, schedule, identification signal, verification arrangements and address. In addition to the directory of stations, it contains authoritative articles by leading personalities in the radio and TV fields of

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NAME ....

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.... 5/66

various countries, world maps and other useful data.

This 1966 edition features articles on international television, colour television, DX clubs and DX transmissions, Esperanto, reception conditions expected in 1966, and international broadcasting organisations. Data includes information about solar activity in 1966, allocation of frequency bands, call sign allocations and standard frequency and time signal stations. Our copy supplied by Technical Book and Magazine Co. Pty. Ltd., 289-299 Swanston Street, Melbourne, C.1. (H.A.T.).

★ ★ ★

PRINCIPLES OF AERIAL DESIGN, by H. Page, M.Sc., M.I.E.E. Published by Iliffe Books Ltd. Contains 172 pages, 8¾ x 5½in, with many diagrams, illustrations and formulas.

This copy of the above book was submitted to us in the form of a bound rough proof. We are told that . . . "All finished books will of course be properly bound, printed on good quality paper and any errors corrected." From this, and with previous experience of books from the same publishers, we can reasonably assume that the binding will include a hard cover.

Although this is not a long work in terms of pages, it nevertheless contains a considerable amount of information on the theory and approach to aerial design. In addition to the usual preface and index, with an appendix, there are five somewhat lengthy chapters. These chapters are listed as follows:

1. The laws governing electric and magnetic phenomena.
2. Maxwell's electromagnetic wave equations.
3. Applications of Maxwell's equations.
4. Aerials: theoretical design principles.
5. Aerials: practical forms.

This book is obviously intended for the design engineer and the first three chapters are devoted to the theory of electromagnetic radiation. It should be of particular interest to those engaged in this field, or likely to be so engaged.

Chapter four deals with the theoretical design of aerials with some good explanations which may be readily understood by the advanced technician. However, there is considerable mathematical treatment, as would be expected, and most of this is again at engineering level.

Chapter five is a practical approach to aerials, once again at engineering level. However, some useful information could be gleaned from it by the advanced technician.

To sum up, a worthwhile and interesting treatment of the subject, of use for engineers and students but not particularly recommended for those at technician level.

Our copy came from the Technical Book and Magazine Co. Pty. Ltd., of 295-299 Swanston Street, Melbourne. Copies should be available shortly and the Australian price is $7.80. (I.L.P.)

★ ★ ★

PRINCIPALS AND APPLICATIONS OF BOOLEAN ALGEBRA FOR ELECTRONIC ENGINEERS, by Salvatore A. Adelfio, Jr., and Christine F. Nolan. Published by Iliffe Books Ltd., London, 1965. Hard covers, 5½in x 8½in, 319 pp., many diagrams. Price in Australia $7.

One would naturally infer from the somewhat cumbersome title of this volume that it was intended for those at engineering level; or at least for advanced students. However to judge by its contents this can hardly be the case, as at least one-fifth of its pages are given to introduction of elementary circuit theory and electronics.

I think one could quite reasonably expect that engineers would be fairly familiar with such things as Ohm's Law, R-C time constants, the thermionic diode valve and the transistor; at least by the time they have to start worrying about the applications of symbolic logic . . .

Apart from this apparent conflict between title and content the book appears to be a fairly conventional introduction to logic circuits, There are chapters dealing
number systems and codes, arithmeti
erations in different radix systems, Bo
algebra basics, graphical methods,
tables, problem solving and minimis
diode and transistor logic circuits, and
tronic counters.

As with a regretably large proporti
books covering the same material, the
introduction of Boolean algebra is sk
and unenlightening. A blunt and unsu
ted statement of the definitions and
ulates is followed hurriedly by logic
and their combination. As far as I ca
there is no attempt to show the develo
and validity of Boole's postulates (
them this for brevity, although I am
of the important contributions by
such as deMorgan, Jevons and Shan
nor is there an answer to what is pro
the first question asked by a newcom
the field: Why and how does log
algebra come into electronics?

Quite apart from this there is a g
error in the list of Boolean post
(p.52) the description of conju
("AND") is exactly the same in for
that for disjunction ("OR") immediatel
ceding it. However the sample review
a rough proof and this error may be
rected in the final copies.

To sum up, then, I find it very diffic
recommend this volume on any sco
doesn't seem particularly suited for the
pose suggested by its title; on the co
it tries to teach the engineer thing
should already know, yet omits a nu
of things he will both want and
to know . . .

Our copy came from the Technical
and Magazine Company Pty. Ltd.
295-299 Swanston Street, Melbourne,
whom copies will be obtainable by
(J.R.)

★ ★ ★

**RELIABILITY OF ELECTRONIC
PONENTS, by C. E. Jowett.
lished by Iliffe Books Ltd., Lo
Contains 165 pages, 8½ x 5½in,
illustrations and many tables. A
lian price, $6.60.**

The task of compiling all the inform
contained in this volume must have
very considerable indeed. In my op
the author has done a good job an
book should be valued by all interest
its contents. The range of component
other relevant subjects covered shoul
adequate for most interested readers
here is a list of the chapter heading

1. Environmental conditions and a
pheric corrosion.
2. Soldering and crimping.
3. Resistors.
4. Capacitors.
5. Thermionic valves.
6. Transistors and diodes.
7. Metal rectifiers (selenium).
8. Transformers and inductors.
9. Relays.
10. Radio frequency cables.
11. Electrical contacts.
12. Printed circuits and wiring.
13. Potted components and encapsul

Each chapter deals with the variou
pects of the subject in a businesslike
ner, listing faults and their causes and
sible cures. In cases of components
as resistors and capacitors, the chap
broken down to cover each type an
faults peculiar to each are dealt
accordingly.

In short, this is a book which shou
in the libraries of all production and
engineers associated with the electroni
dustry. Indeed, it would also be of in
to anyone closely associated with th
of electronic components.

Our copy came from the Technical
and Magazine Co. Pty. Ltd., 28
Swanston Street, Melbourne. Similar t
copy of "Principles of Aerial De
which I reviewed, this one is also in t
rough proof form and the same com
apply, in that I assume that the bindin
include a hard cover and copies shou
available shortly. (I.L.P.).

ATIONAL BUREAU OF STAND- DS TECHNICAL NEWS BULLETIN October, 1965 (Vol. 49, No. 10) con- s articles on heat of vaporisation of temperature metals, ethylene nitrogen n reaction, improved dipole measure- it, temperature effect on optical windows, soidal mirror reflectometer, the 50th ional Conference on Weights and Meas- , migration-free condensation in tung- , simplified method for making quarter- e plates, optical constants of iron. A list ublications currently available from the ional Bureau of Standards is also given. uiries to Superintendent of Documents, . Government Printing Office, Washing- U.S.A.)

ATIONAL BUREAU OF STAN- RDS TECHNICAL NEWS REVIEW December, 1965, (Vol. 49, No. 12) has cles about package checking procedures Aerosol products, dye systems for mea- ng large radiation doses, calculation of earth ionisation energies, observation new free radical, CLCO, discovered by eau staff, an improved method for rapid lysis of paint pigments, evaluation of hods of measuring small spheres, nuclear netic resonance in bulk magnetic metals, rmination of molten salt concentrations equations developed for glass mem- ne electrodes; a new technique to ieve absolute purity; and news items n the fields of science and standardis- n in the U.S.A. (Inquiries to Superin- dent of Documents, U.S. Government ting Office, Washington, D.C., 20402.)

ULLARD OUTLOOK issue dated Jan- y-February, 1966 (Vol. 9, No. 2) has article entitled "Low Cost High-quality id State Audio Frequency Amplifiers" ch is intended as an introduction to a es of articles on solid state amplifiers be published in future issues of "Out- k." Another article entitled "How Much Margins Matter" deals with the re- onships of profit and margins in busi- . New products described include Ferrox- e Toroids with nylon coating, and the 070 45mA/V wideband output pentode. luded in this issue is a separate four- e index for Vol. 8 (1965). Inquiries uld be addressed to Mullard-Australia . Ltd., 35-43 Clarence Street, Sydney State branch offices.

CA OF AUSTRALIA PTY. LTD. will ply a handsomely printed handbook of fidelity and stereo published by the ier Radio Corporation of U.S.A., free post free, on request. While a large portion of the space in the 72-page klet is devoted to description of Fisher lifiers, loudspeakers and audio accessor- it also contains a number of useful cles for the guidance of those interested igh fidelity reproduction, advice on plan- installations, and a glossary of high lity terms.

equests for a copy of the booklet should sent to RCA of Australia head office 221 Elizabeth Street, Sydney, or branch ces in Melbourne, Brisbane and Perth.

TC COMPONENTS AND EQUIP- NT REVIEW dated February, 1966 l. 3, No. 2) gives test specifications and formance characteristics of a new range electrolytic capacitors to MIL-C-62B ch will be available from STC shortly. o described are new varactor diodes for in harmonic generators and up-con- ers; STC mercury wetted relays; minia- electrolytic capacitors Z-61761; and tal modules Series 10A and 10B. (Stan- d Telephones and Cables Pty. Ltd., In- trial Products Division, Moorebank Ave- , Liverpool, N.S.W.).

.T.C. COMPONENTS AND EQUIP- NT REVIEW contains information on following products: Jennings vacuum acitors; STC 7007 forced-air-cooled ode, which is a direct replacement for American type 7007; Type SU 7090 eral purpose industrial relay; ITT tan- m capacitors; ISEP edge connectors. ger articles deal with ITT four-layer des in multivibrator circuits, and epi- als planar transistors. ■

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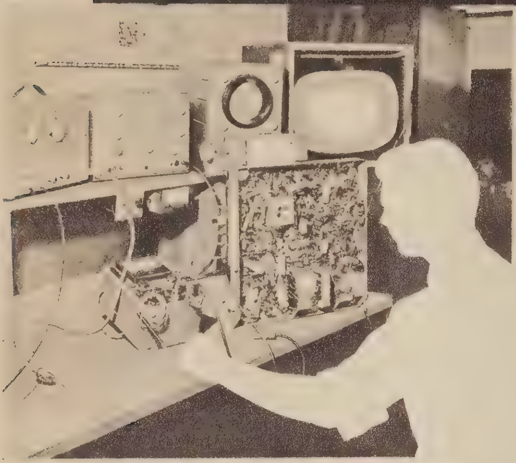

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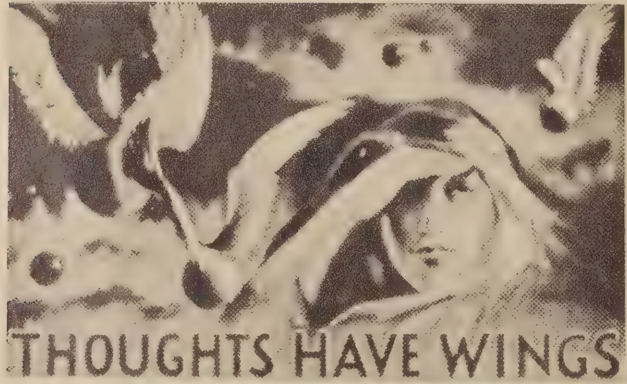

You Can Influence Others With Your Thinking!

TRY IT SOME TIME. Concentrate intently upon another person seated in a room with you, without his noticing it. Observe him gradually become restless and finally turn and look in your direction. Simple—yet it is a *positive demonstration* that thought generates a mental energy which can be projected from your mind to the consciousness of another. Do you realize how much of your success and happiness in life depends upon your influencing others? Is it not important to you to have others understand your point of view—to be receptive to your proposals?

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How many times have you wished there were some way you could impress another favorably—*get across to him or her your ideas?* That thoughts can be transmitted, received, and understood by others is now scientifically demonstrable. The tales of miraculous accomplishments of mind by the ancients are now known to be fact—not fable. The method whereby these things can be *intentionally*, not accidentally, accomplished has been a secret long cherished by the Rosicrucians—one of the schools of ancient wisdom existing throughout the world. To thousands everywhere, for centuries, the Rosicrucians have privately taught this nearly-lost art of the practical use of mind power.

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Name..
Address..
State..

ANSWERS TO CORRESPONDENTS

hen writing to us:—

'lease give your name and full
›ostal address, including the
itate . . . N.S.W. &c.

Vrite the above information
:learly or, for preference, print
t in block letters. Your co-
›peration will facilitate deliv-
:ry of replies by mail, where
uch are called for.

SUBSTITUTE COMPONENTS

. (Mt. Seymour, Tas.) writes stating his
ntention of building our stereo ampli-
ier featured in May 1959. He asks
vhether he may substitute a power
ransformer on hand for the original
ınd whether, with suitable alterations,
CM5 valves could be used in the out-
ut stages.
power transformer mentioned would
e suitable for this amplifier and we
ot recommend the use of 6CM5s in
ircuit. From time to time we get re-
s of this nature re substitution of parts
valves in published circuits. In most
cations published circuits have been
carefully tailored around the compon-
nominated. Substitution of anything
lirect equivalent components in these
its can mean a complete re-design in
onent values and lay-out to get com-
le results. When designing the proto-
of our featured articles careful con-
ition is given to availability of com-
nts and relative costs. We endeavour
roduce a finished article which will
adequate performance at the minimum
which will not affect this performance.
e components used to build one of
circuits are varied or a different
anical layout is made then we cannot
ntee the results will be the same as
of the original.

TV SOUND

. (Moulamein, N.S.W.) in his letter
outlines his interest in a TV sound
uner. He points out the difficulty in
purchasing records in country areas
where it may be necessary to order
discs unheard. He continues by stating
hat while some pleasure may be had
by listening to music on the only avail-
able TV channel it seems pointless in
watching a test card or still pictures
during this period together with the
hought that there is needless deterio-
ation of components in the TV set.
xplained in a recent "Answer Man"
e, the production of a TV sound tuner
ch more complex than a standard FM
. The cheapest way to listen to TV
l is with a TV set — despite the extra
ting hours.

PRICE ESTIMATE

W. (Gladesville, N.S.W.) writes asking
why instead of the Vari-Watt Power
controller we could not substitute a
simple rheostat in series with the ap-
pliance. Also, he continues, why not
publish the cost of equipment described
in this magazine?
nswer to your first query, when the
oller is used near its maximum ratings,
required to handle approximately 1000
. A rheostat capable of handling this
of power is certainly not a simple
tat. The new controller virtually
ches off" the supply over significent
ons of the input cycle. It does not just
ate input power as heat. We deliberately avoid giving price estimates for our products, as these would cause more confusion than it would save. Prices are subject to variation from time to time and differ between sources of supply, and with the basis on which parts are offered, notably wholesale, retail or kit price. We leave it to our advertisers to quote as they see fit in the full knowledge that normal competition will ensure the best possible deal for prospective constructors.

GENERAL COMMENT

E. C. (Heidelberg, Vic.) comments on a number of items mentioned in our December and January issues.

Thank you for your various observations. Regarding reticulation poles, you will probably find that there are sound economic reasons why public utilities use wooden poles in some areas and for some applications, and use materials other than wood for others. We recollect having seen references, at times, to this general subject. You would not necessarily hear any difference between the two halves of a stereo broadcast by tuning from one to the other on a single receiver; doing this, you could not be aware of the vital difference in phase and even the difference in balance between the instruments may be hard to pick in many items. Yes, undoubtedly we will get colour television in Australia and, technically, we could have it in a relatively short time; but there are important economic factors to be considered. Your observations about the ancient goldbeater's craft are interesting but they have little bearing on the problems of a modern plater concerned with critical electronic components. Regarding the historical references on page 93 of the January issue, this material was prepared by our Amateur Band correspondent, Mr Pierce Healy.

FREQUENCY DOUBLING

J.L. (Mt. Albert, N.Z.) referring to recent discussion of "Alvin Generators" says that there is no special problem about frequency doubling and mentions in particular full-wave rectifier systems and saturated reactors.

You are quite correct—up to a point! These and other methods can be used to produce an output at twice the input frequency. We actually used a full-wave rectifier system in our Playmaster electronic organ to provide 4ft tones from 8ft generators. You have missed the whole point, however, in that this technique is applicable only to single tones or frequencies. If the input contains more than one frequency, the output will contain not only double frequency components but intermodulation products, which the ear would hear as high—and probably intolerable—distortion. In short, none of these simple schemes are practical for complex signals.

TV AERIALS

R.J.P. (Goulburn, N.S.W.) writes explaining the reception of various TV stations in his location. He inquires as to the best method of improving this reception on certain channels.

We are not in a position to advise about the results likely to be obtained from the various commercial TV antennas. If your present antenna was purchased before the advent of Channel 10 we suggest that you contact the place of purchase, or the manufacturers, and inquire as to the response of the antenna on this channel. Stacking two similar antennas will usually improve reception but, owing to the wide variety of channels being viewed, it will be found that the stacking distance will give different additional gain figures for these channels. The manufacturer's stacking bars for your particular antenna should be used.

Your Channel 7 interference cannot be overcome by a filter as this would remove the desired signal also. If a rotator is used on the main antenna system it may be possible to swing the antenna so that the undesired transmission falls in a null of the antenna pattern while still picking up a reasonable signal from the desired station. This of course also applies to Channel 3. Note also that it should be possible to take advantage of the difference in polarisation.

We note your comments regarding the reception of New Zealand TV. This is quite a common occurence during the summer months in Australia and is known to happen occasionally during the rest of the year. These signals are thought to be brought about by sporadic E layer reflection.

"ELECTRONICS Australia" INFORMATION SERVICE

TO assist readers, "ELECTRONICS Australia" conducts a technical information service. Conditions governing this service are set out below:—

(1) Address letters to: Assistant Editor, "ELECTRONICS Australia," Box 2728, G.P.O., Sydney.

(2) Requests for copies of circuits or technical information requiring a postal reply must be accompanied by postal note or stamps to the value of $0-20 (2/-). Queries not accompanied by a fee will be answered in rotation on these pages.

(3) For the $0-20 fee, we will supply circuit data, as available, from our files. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuits will be answered more speedily if they are not complicated by questions requiring the attention of technical personnel. Where articles are not on file we can usually provide a photostat copy at $0-20 PER PAGE.

(4) The information service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits. Please note that the inclusion of an extra fee does NOT entitle correspondents to special considerations.

(5) The editor reserves the right to return fees or to limit the scope of an individual reply when it is felt that a partial answer will be better than none at all.

(6) In addition to the above service, chassis blueprints are available for most of our projects showing the position of holes and cutouts for metal-working, but containing no details of wiring. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost $0-50 (5/-) each. Original photographs of most projects are also available, from $0-50 for a 6in x 8in glossy print, postage $0-08 (9d).

(7) "ELECTRONICS Australia" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications should be obtained from advertisers.

(8) Technical queries are not answered by telephone.

(9) We have no file of circuits for commercial radio or TV sets, etc.

(10) A fairly good range of back numbers is available. On issues up to 6 months old there is a surcharge of 5c (6d). On issues from 7 to 12 months old the surcharge is 10c (1/-). Over 12 months, it is 20c (2/-).

ANSWERS TO CORRESPONDENTS

E. A. BADGE

G. F. (Address omitted) asks whether we could issue a badge carrying the words "ELECTRONICS Australia."

As you say, it generally pays to advertise but we must confess to not having considered this idea. Who would want it and what for? Would they wear it on their coat or attach it to projects? We'll give the idea some thought.

DAMPING FACTOR

B.V. (Daglish, W.A.) wants to know the meaning of the term "damping factor" in connection with loudspeakers, and how it can be calculated.

Damping factor expresses the relationship between the effective internal impedance of an audio power amplifier and the impedance of the loudspeaker system into which it is operating. For example, if the impedance of the loudspeaker voice coil is 15 ohms, and the effective internal resistance of the amplifier is 3 ohms, the damping factor is 15/3 equals 5. The various factors involved are too complicated to deal with here, but we may be able to give a more detailed explanation in a future issue. Two points are perhaps worth mentioning. The effective internal resistance of amplifiers is reduced by negative voltage feedback, and a high damping factor contributes to improved speaker performance.

MICRO COMPUTER

C.W. (Elizabeth Vale, S.A.) says that he was interested in the February article on "Europe's First Micro Computer." He says, however, that two competitive machines are available, the Ferranti Argus 400 and the Argus 500, the former also having been claimed as Europe's first.

It is almost impossible for an editorial staff to verify all the statements made in contributed articles and a great deal of reliance has to be placed on authors and/or sources. Presumably, there is a difference of opinion between Marconi and Ferranti interests as to whom was first. At this distance it probably doesn't matter much, the important point having been made in your letter, that alternative equipments are on offer.

SOLAR RADIATION

D. P. (South Hobart, Tas.) is interested in receiving and recording solar radiation at VHF and UHF and would like to get in touch with a club or another reader interested in amateur radio astronomy.

We cannot supply any names or addresses but someone interested may happen to note this and want to contact you. (Mr David Patterson, 5 Livingstone St., South Hobart, Tas.) ◆

SERVICEMAN—cont.

though they are quite confident they do know it.

Inspired by the foregoing story I made some observations and quest my more observant colleagues o subject. Here is a summary o observations.

The AC spark is more curved, r around quite a deal, and is pred antly blue in colour. The DC produces a characteristic "hiss" a lead is brought close to the chas more nearly white, is steadier, but break into several sparks radiating the lead as the distance is reduc

For myself, I am inclined to that it is the sound, particularly "hiss" mentioned above, which i most prominent clue, followed b colour. Other characteristics, shape, are likely to be influenced by f which may not always be constan

Anyway, there are my thought the subject, and which I hope may the less experienced. If you h had a chance to notice the diffe yet, keep your eyes—and ears—ope it. If you have, and you have comments to make on the nature differences let's hear about them; might help someone else.

There's an AIWA microphone to solve your recording problem.

AIWA DM.57 DYNAMIC MICROPHONE—Impedance: 60 and 50K. Frequency Response: 100-13,000 cps. Sensitivity: 75 db's. Dimensions: 7¾" x 1¾". Weight: 14 ozs. **$16.80**

AIWA DM.17 OMNI-DIRECTIONAL DYNAMIC BOOM MICROPHONE—Impedance: 50K or 50Ω. Frequency Response: 70-14,000 cps. Sensitivity: 75 db's. Dimensions: 55⅝" x 1⅝". Weight: 10½ ozs. **$16.80**

AIWA DM.51 DYNAMIC MICROPHONE. Impedance: 50Ω or 50KΩ. Frequency Response: 50-15,000 cps. Sensitivity: 55 db's. Dimensions: 10" x 1⅜". Weight: 29 ozs. **$27.00**

AIWA DYNAMIC NON-DIRECTIONAL MICROPHONE DM.13—Impedance: 50K or 50Ω. Frequency Response: 60 c's-14,000 cps. Sensitivity: 55 db's. Dimensions: Length 10½". Weight: 18½ ozs. **$23.00**

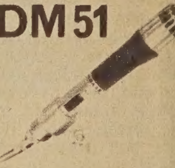
AIWA UNI-DIRECTIONAL DYNAMIC MICROPHONE DM.47—Impedance: 50Ω or 50K. Frequency Response: 40-18,000 cps. Sensitivity: 75 db's. Dimensions: 5½" x 1 3/16". Weight: 18 ozs. with cord. **$36.00**

AIWA DM.10 DYNAMIC DESK MICROPHONE—Impedance: 50KΩ or 50Ω. Frequency Response: 60-13 Kc's. Sensitivity: 75 db's. Dimensions: 7¼" x 1¼". Weight: 11 ozs. without stand. **$16.80**

AIWA DM.14 DYNAMIC MICROPHONE—Impedance: 50Ω or 50K. Frequency Response: 90 c's-14,000 cps. Sensitivity: 75 db's. Dimensions: 3⅜" x 1¾". Wt. 10 ozs. **$12.50**

DM57

DM17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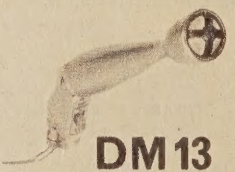
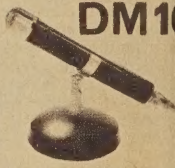

DM13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ADVERTISING INDEX

A. and R. Transformers Pty. Ltd. . .
A.C.E. Radio 124, 125, 12
Acme Eng. Co. . . . .
Adcola Pty. Ltd. . . . .
Aegis Products Pty. Ltd. . . . .
Agfa Pty. Ltd. . . . .
AKAI Electric Co. Ltd. . . . .
Amalgamated Wireless (A'sia) Ltd. Inside Front Cover, 56,
Amalgamated Wireless Valve Co. . . . .
Amateur Astronomer Supply Co. . . . .
Amplion (A'sia) Pty. Ltd. 61,
Anodeon Sales Div. . . . .
Arrow Electronics Co. Pty. Ltd. . . .
A.R.T.C. . . . . Back
Asdic Stereo Specialists and Brisbane Agencies . . . . Inside Back
Audio Eng Pty. Ltd. . . . .
Australian Sound and TV Co. . . . . .
Australian Electronics . . . .

Bright Star Radio Pty. Ltd. . . . . .
Broadway Electronics Pty. Ltd. . . . 2,
Broughton, Peter . . . .

Capital Radio Eng. Inst. . . . .
Central Imports Pty. Ltd. . . . . . .
Classic Radio 102
Classic Tape Recorders . . . .
Classified . . . .
Clow Sound Systems . . . .
Convoy International Imports 7

Danish-Hi-Fi Pty. Ltd. . . . .
Deitch Bros. . . . .
Deitron Electronics . . . .

Electronic Developments Pty. Ltd. . .
Encel Electronics . . . .
Ericsson L. M. Pty. Ltd. . . . . . .

Fairchild Australia Pty. Ltd. . . 73, 74,
Ferguson (Adelaide) Pty. Ltd. 51
Fox and MacGillycuddy Pty. Ltd. . . .

General Accessories Pty. Ltd. . . . .
General Electric Pty. Ltd. . . . . . .
Goldring Eng. Pty. Ltd. 111
Goodmans . . . .
G.R.D. Instruments Pty. Ltd. . . . . .

Ham Radio Suppliers . . . .
H.B. Radio Sales 63
Homecrafts Pty Ltd. . . . .

International Correspondence Schools . .

Jacoby, Mitchell and Co. Pty. Ltd. . .
JH Reproducers Pty. Ltd. . . . . . .
Johnston D. R. Pty. Ltd. . . . . . .

Kodak (Australasia) Pty. Ltd. . . . .

Lafayette Electronics . . . .

McLellan, W J. and Co. Pty. Ltd. . .
Magrath, J. H. and Co. Ltd. . . . . .
Man's World . . . .
Manufacturers Special Products . . 8,
Marconi School of Wireless . . . . . .
Master Electrics Pty. Ltd. . . . . . .
Mastersound Sales Pty. Ltd. . . . . .
Maurice Chapman Pty. Ltd. . 22, 54,
Mullard-Australia Pty. Ltd. . . . . .

National Radio Supplies 13

Paton Electrical Pty. Ltd. . . . . . .
Philips Electrical Pty. Ltd. . . . . .
Pye Pty. Ltd. . . . .
Precision Windings . . . .

Radio Despatch Service . . . .
Radio House Pty. Ltd. . . . .
RCA of Aust. Pty. Ltd. 34,
R.C.S. Radio Pty. Ltd. . . . .
Recorded Music Salon 84
Rosicrucians . . . .
Rowe H. and Co. Pty. Ltd. . . . . . .

Selwyn Russel . . 45, 49, 51, 105, 10
Simon Gray Pty. Ltd. 24, 88
Stotts Correspondence School . . . . .
Sure Brite Picture Tubes . . . .

Texas Instruments . . . .
The Reader's Digest . . . .
Thorn Special Products . . . .
Top Management Pty. Ltd. . . . . . .
T.O.S.C.A. Pty. Ltd. . . . .
Transistor Kits . . . .

United Radio Distributors . . . . . .
University Graham Instruments . . . .

Warburton Franki Ltd. 26, 8
Watkin Wynne Pty. Ltd. . . . .
William Willis and Co. Pty. Ltd. 47
Willis S. E. Pty. Ltd. . . . .
Wonder Wool . . . .

Zephyr Products Pty. Ltd. 44, 11